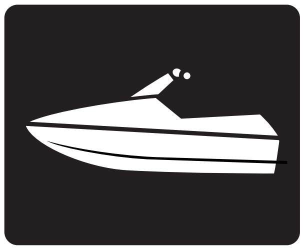
YAMAHA



WaveRunner

# VX110 Sport
# VX110 Deluxe

## SERVICE MANUAL

LIT-18616-02-91

F1K-28197-1H-11

# NOTICE

This manual has been prepared by Yamaha primarily for use by Yamaha dealers and their trained mechanics when performing maintenance procedures and repairs to Yamaha equipment. It has been written to suit the needs of persons who have a basic understanding of the mechanical and electrical concepts and procedures inherent in the work, for without such knowledge attempted repairs or service to the equipment could render it unsafe or unfit for use.

Because Yamaha has a policy of continuously improving its products, models may differ in detail from the descriptions and illustrations given in this publication. Use only the latest edition of this manual. Authorized Yamaha dealers are notified periodically of modifications and significant changes in specifications and procedures, and these are incorporated in successive editions of this manual.

A10001-0*

**WaveRunner**
**VX110 Sport, VX110 Deluxe**
**SERVICE MANUAL**

**1st Edition, January 2005**

**Printed in USA**
**LIT-18616-02-91**

# HOW TO USE THIS MANUAL

## MANUAL FORMAT

All of the procedures in this manual are organized in a sequential, step-by-step format. The information has been compiled to provide the mechanic with an easy to read, handy reference that contains comprehensive explanations of all disassembly, repair, assembly, and inspection operations.
In this revised format, the condition of a faulty component will precede an arrow symbol and the course of action required will follow the symbol, e.g.,

- Bearings
  Pitting/scratches → Replace.

To assist you in finding your way through this manual, the section title and major heading is given at the top of every page.

## ILLUSTRATIONS

The illustrations within this service manual represent all of the designated models.

## CROSS REFERENCES

The cross references have been kept to a minimum. Cross references will direct you to the appropriate section or chapter.

## IMPORTANT INFORMATION

In this Service Manual particularly important information is distinguished in the following ways.

⚠ The Safety Alert Symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

**⚠ WARNING**

**Failure to follow WARNING instructions could result in severe injury or death to the machine operator, passenger(s), a bystander, or a person inspecting or repairing the watercraft.**

**CAUTION:**

**A CAUTION indicates special precautions that must be taken to avoid damage to the watercraft.**

**NOTE:**

A NOTE provides key information to make procedures easier or clearer.

**IMPORTANT:**

This part has been subjected to change of specification during production.

## HOW TO USE THIS MANUAL

① To help identify parts and clarify procedure steps, there are exploded diagrams at the start of each removal and disassembly section.

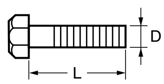
② Numbers are given in the order of the jobs in the exploded diagram.

③ Symbols indicate parts to be lubricated or replaced (see “SYMBOLS”).

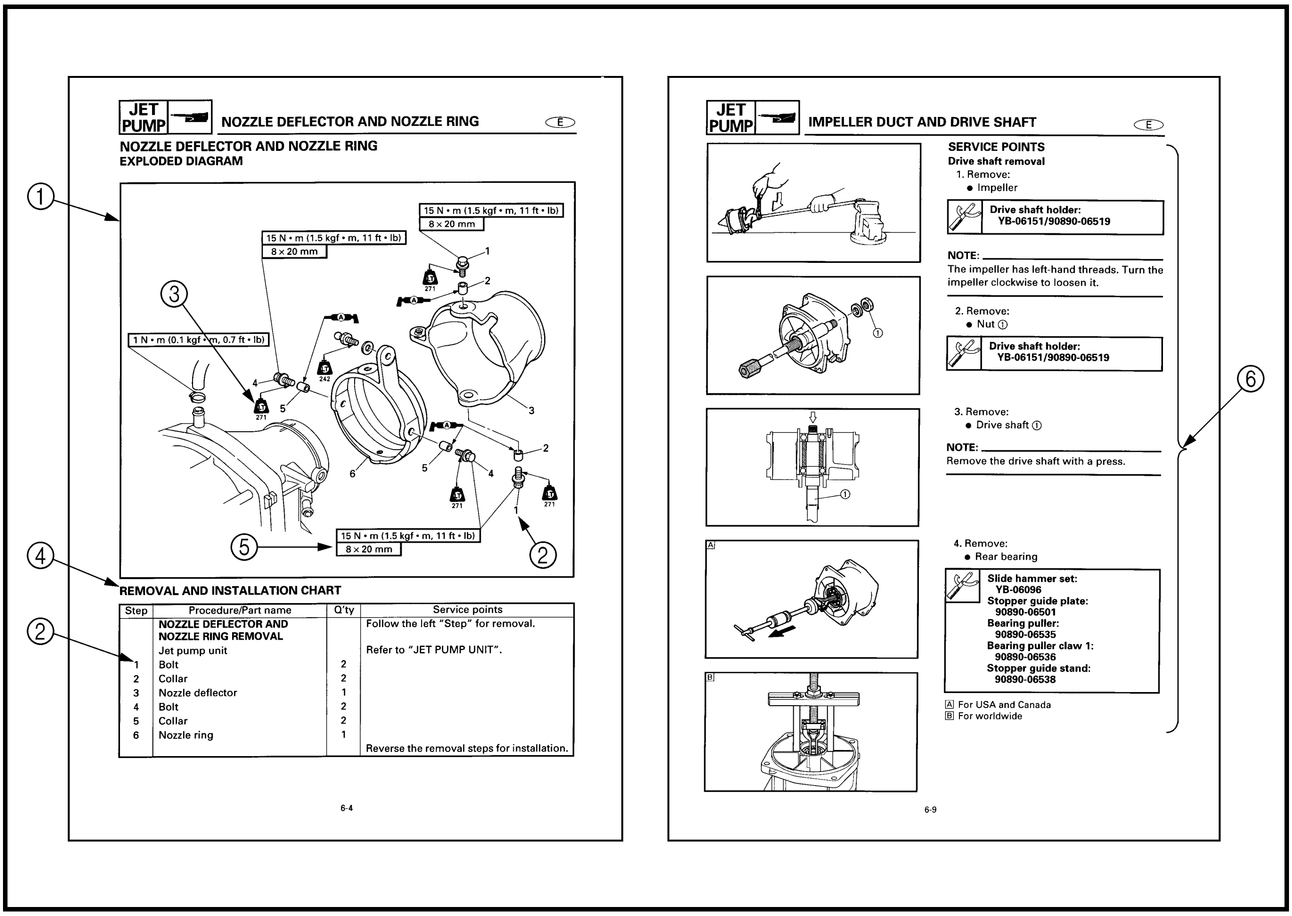
④ A job instruction chart accompanies the exploded diagram, providing the order of jobs, names of parts, notes in jobs, etc.

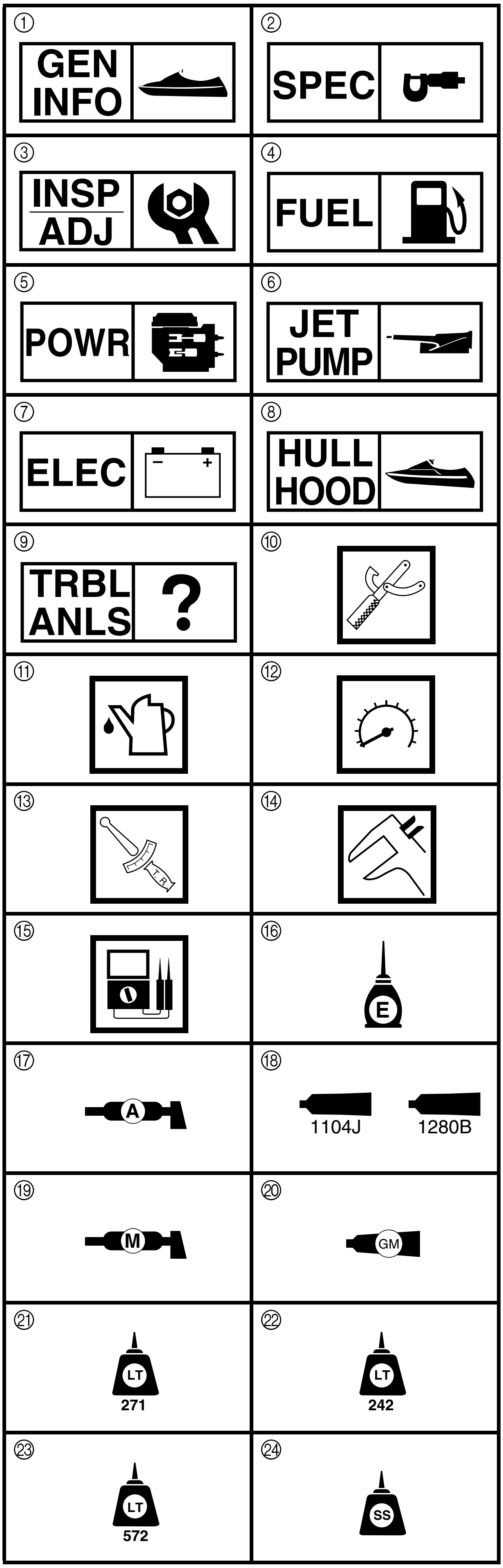
⑤ Dimension figures and the number of parts, are provided for fasteners that require a tightening torque.

Example:
Bolt or screw size | 10 × 25 mm | : M10 (D) × 25 mm (L)




⑥ Jobs requiring more information (such as special tools and technical data) are described sequentially.






A50001-1-4

## SYMBOLS

Symbols ① to ⑨ are designed to indicate the content of a chapter.

① General Information
② Specifications
③ Periodic Inspection and Adjustment
④ Fuel System
⑤ Power Unit
⑥ Jet Pump Unit
⑦ Electrical System
⑧ Hull and Hood
⑨ Trouble Analysis

Symbols ⑩ to ⑮ indicate specific data.

⑩ Special service tool
⑪ Specified oil or fluid
⑫ Specified engine speed
⑬ Specified tightening torque
⑭ Specified measurement
⑮ Specified electrical value
(resistance, voltage, electric current)

Symbols ⑯ to ⑲ in an exploded diagram indicate the grade of lubricant and the lubrication point.

⑯ Apply Yamaha 4-stroke motor oil
⑰ Apply water resistant grease
(Yamaha grease A, Yamaha marine grease)
⑱ Apply ThreeBond 1104J or ThreeBond 1280B
⑲ Apply molybdenum disulfide grease

Symbols ⑳ to ㉔ in an exploded diagram indicate the type of sealant or locking agent and the application point.

⑳ Apply Gasket Maker
㉑ Apply LOCTITE 271 (red)
㉒ Apply LOCTITE 242 (blue)
㉓ Apply LOCTITE 572
㉔ Apply silicone sealant

**NOTE:**
Additional symbols may be used in this manual.

E

A30000-0

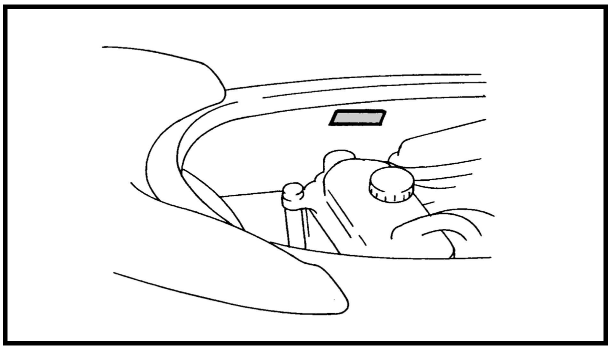
# INDEX

# CHAPTER 1
# GENERAL INFORMATION

A60700-0*

# IDENTIFICATION NUMBERS

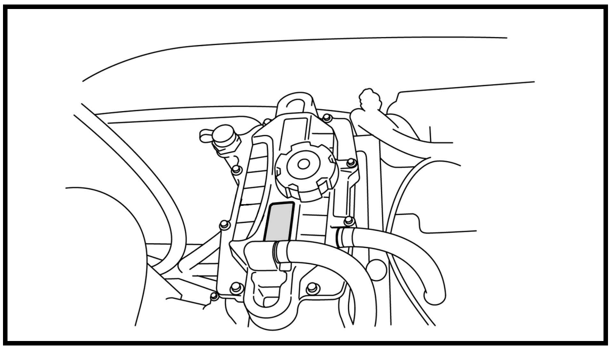
## PRIMARY I.D. NUMBER



The primary I.D. number is stamped on a label attached to the inside of the engine compartment.

**Starting primary I.D. number:**
**F1K: 800101**

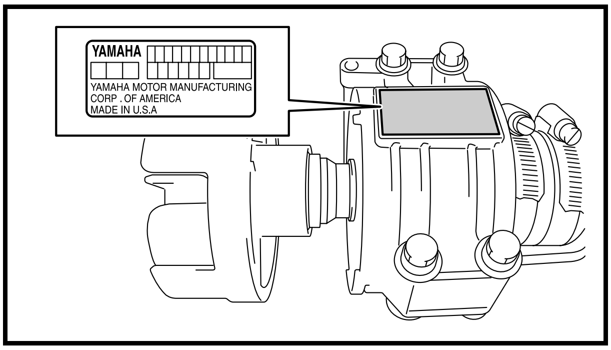
## ENGINE SERIAL NUMBER



The engine serial number is stamped on a label attached to the engine unit.

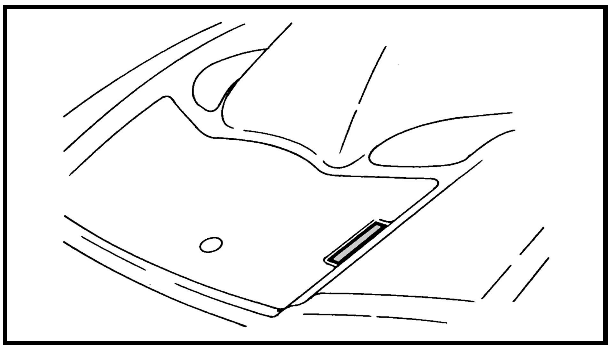
**Starting serial number:**
**6D3: 1000001**

## JET PUMP UNIT SERIAL NUMBER




The jet pump unit serial number is stamped on a label attached to the intermediate housing.

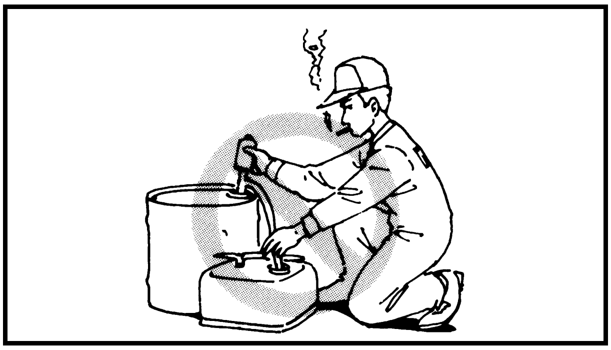
## HULL IDENTIFICATION NUMBER (H.I.N.)



The H.I.N. is stamped on a plate attached to the aft deck.

## ⚠ SAFETY WHILE WORKING

To prevent and accident or injury and to ensure quality service, follow the safety procedures provided below.

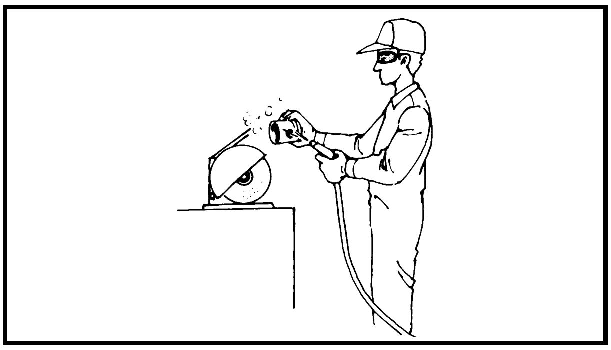


### FIRE PREVENTION

Gasoline is highly flammable.
Keep gasoline and all flammable products away from heat, sparks, and open flames.

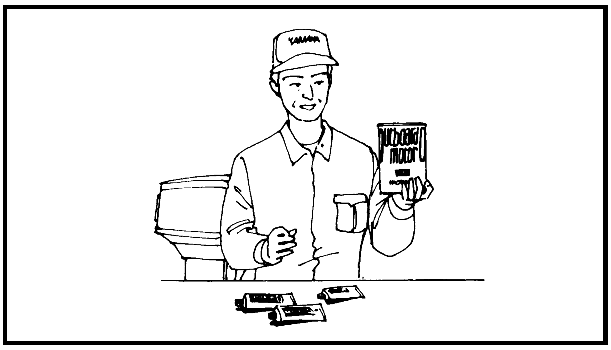
### VENTILATION

Gasoline vapor and exhaust gas are heavier than air and extremely poisonous. If inhaled in large quantities they may cause loss of consciousness and death within a short time. When test running an engine indoors (e.g., in a water tank), be sure to do so where adequate ventilation can be maintained.



### SELF-PROTECTION

Protect your eyes by wearing safety glasses or safety goggles during all operation involving drilling and grinding, or when using an air compressor.
Protect your hands and feet by wearing protective gloves or safety shoes when necessary.

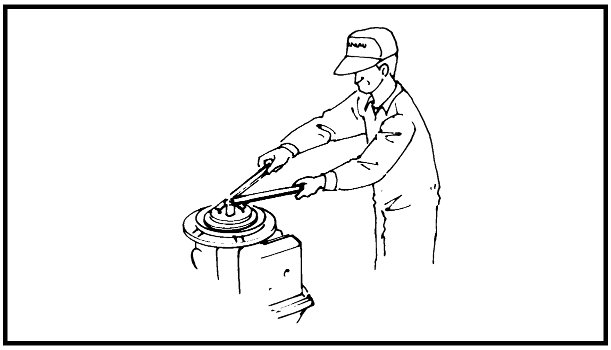


### PARTS, LUBRICANTS, AND SEALANTS

Use only genuine Yamaha parts, lubricants, and sealants or those recommended by Yamaha, when servicing or repairing the watercraft.

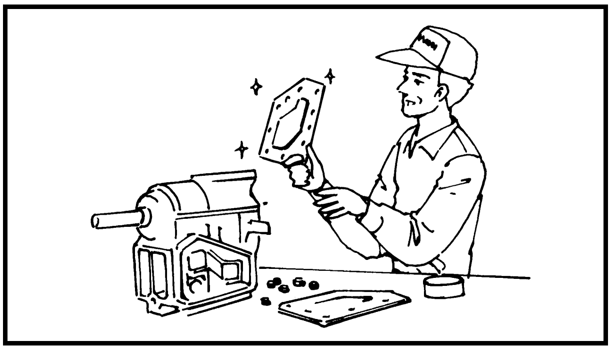
Under normal conditions, the lubricants mentioned in this manual should not harm or be hazardous to your skin. However, you should follow these precautions to minimize any risk when working with lubricants.

1. Maintain good standards of personal and industrial hygiene.
2. Change and wash clothing as soon as possible if soiled with lubricants.
3. Avoid contact with skin. Do not, for example, place a soiled rag in your pocket.
4. Wash hands and any other part of the body thoroughly with soap and hot water after contact with a lubricant or lubricant soiled clothing has been made.
5. To protect your skin, apply a protective cream to your hands before working on the watercraft.
6. Keep a supply of clean, lint-free cloths for wiping up spills, etc.

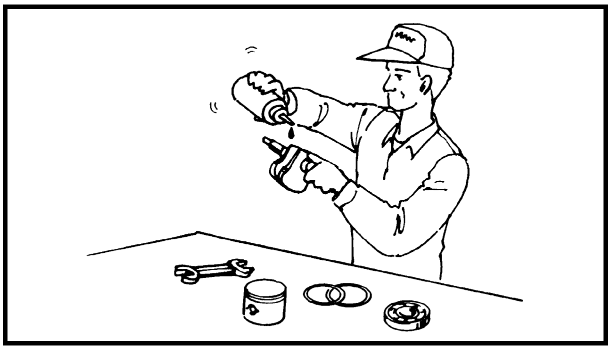


## GOOD WORKING PRACTICES

1. **The right tools**
   Use the recommended special service tools to protect parts from damage. Use the right tool in the right manner—do not improvise.
2. **Tightening torques**
   Follow the tightening torque specifications provided throughout the manual. When tightening nuts, bolts, and screws, tighten the large sizes first, and tighten fasteners starting in the center and moving outward.

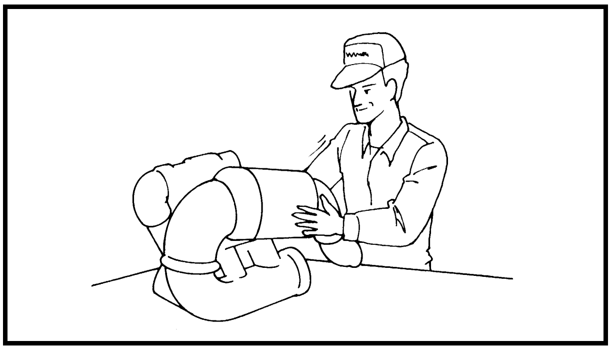


3. **Non-reusable parts**
   Always use new gaskets, seals, O-rings, oil seals, cotter pins, circlips, etc., when installing or assembling parts.



## DISASSEMBLY AND ASSEMBLY

1. Use compressed air to remove dust and dirt during disassembly.
2. Apply engine oil to the contact surfaces of moving parts during assembly.



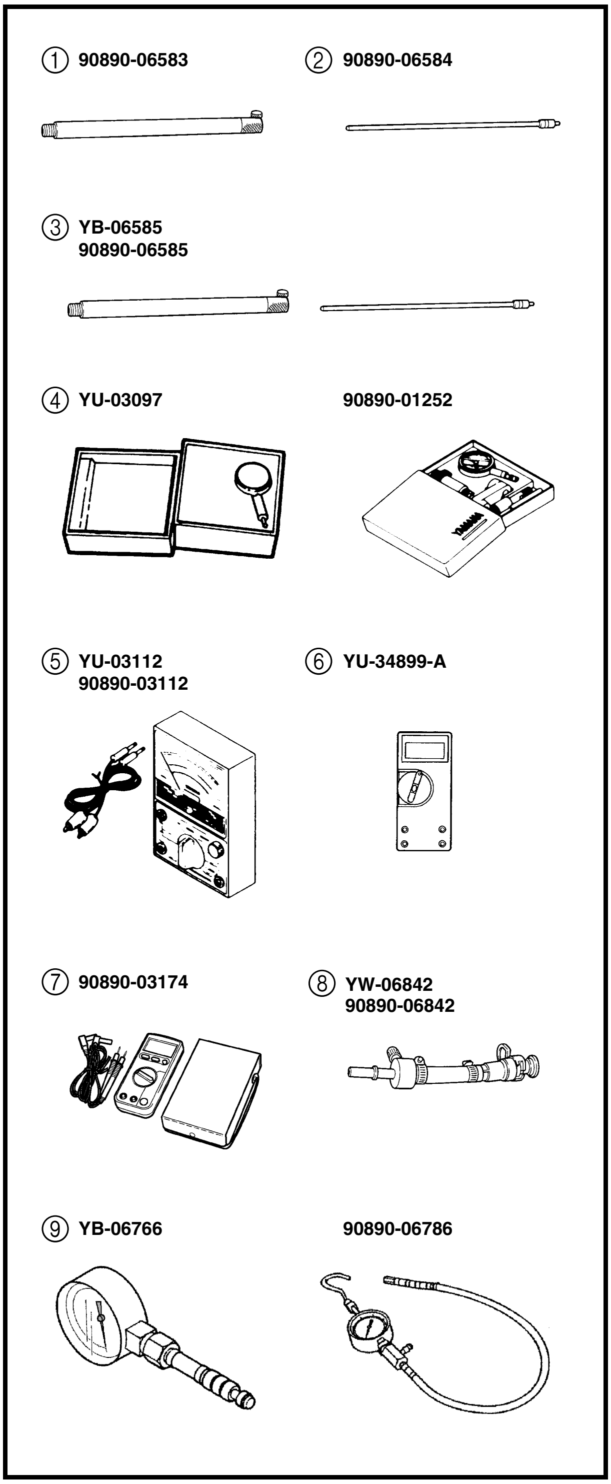
3. Install bearings with the manufacture identification mark in the direction indication in the installation procedure. In addition, be sure to lubricate the bearings liberally.
4. Apply a thin coat of water-resistant grease to the lip and periphery of an oil seal before installation.
5. Check that moving parts operate normally after assembly.

## SPECIAL SERVICE TOOLS

Using the correct special service tools recommended by Yamaha, will aid the work and enable accurate assembly and tune-up. Improvisations and using improper tools can damage the equipment.

**NOTE:**

- For U.S.A. and Canada, use part numbers starting with “J-”, “YB-”, “YM-”, “YS-”, “YU-” or “YW-”.
- For other countries, use part numbers starting with “90890-”.




### MEASURING

① Dial gauge stand
P/N. 90890-06583

② Dial gauge needle
P/N. 90890-06584

③ Dial gauge stand set
P/N. YB-06585
90890-06585

④ Dial indicator gauge
P/N. YU-03097
Dial gauge set
P/N. 90890-01252

⑤ Pocket tester
P/N. YU-03112
90890-03112

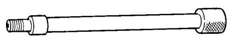
⑥ Digital multimeter
P/N. YU-34899-A

⑦ Digital circuit tester
P/N. 90890-03174

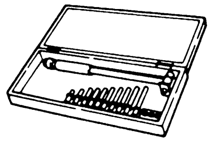
⑧ Fuel pressure gauge adapter
P/N. YW-06842
90890-06842

⑨ Fuel pressure gauge
P/N. YB-06766
90890-06786

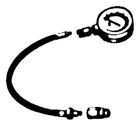
⑩ 90890-06582



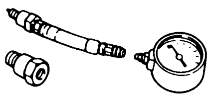
⑪ YU-03017
90890-06759



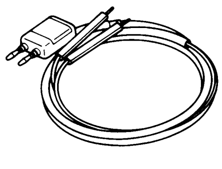
⑫ YU-33223-1



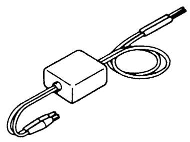
90890-03160



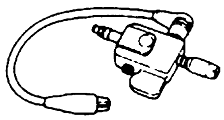
⑬ YU-39991



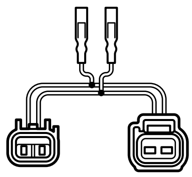
⑭ 90890-03172



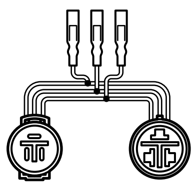
⑮ YM-34487
90890-06754



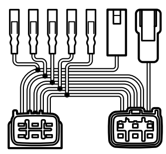
⑯ YB-06867 (-06767)
90890-06867 (-06767)



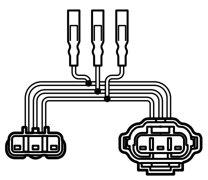
⑰ YB-06870 (-06770)
90890-06870 (-06770)



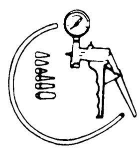
⑱ YB-06848
90890-06848



⑲ YB-06877 (-06777)
90890-06877 (-06777)



⑳ YB-35956-A
90890-06756



⑩ Compression gauge extension
P/N. 90890-06582

⑪ Cylinder gauge set
P/N. YU-03017
90890-06759

⑫ Compression gauge
P/N. YU-33223-1
90890-03160

⑬ Peak voltage adapter
P/N. YU-39991

⑭ Peak voltage adapter B
P/N. 90890-03172

⑮ Spark checker
P/N. YM-34487
Ignition tester
P/N. 90890-06754

⑯ Test harness (2 pins)
P/N. New: YB-06867
Current: YB-06767
Test harness FWY-2 (2 pins)
P/N. New: 90890-06867
Current: 90890-06767

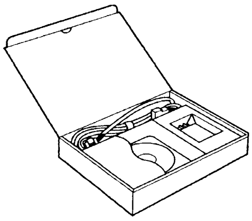
⑰ Test harness (3 pins)
P/N. New: YB-06870
Current: YB-06770
Test harness SMT250-3 (3 pins)
P/N. New: 90890-06870
Current: 90890-06770

⑱ Test harness (6 pins)
P/N. YB-06848
Test harness FSW-6A (6 pins)
P/N. 90890-06848

⑲ Test harness (3 pins)
P/N. New: YB-06877
Current: YB-06777
Test harness HM090-3 (3 pins)
P/N. New: 90890-06877
Current: 90890-06777

⑳ Lower unit pressure/vacuum tester
P/N. YB-35956-A
Vacuum/pressure pump gauge set
P/N. 90890-06756

㉑ 60V-85300-02-00



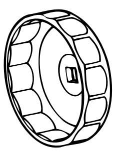
㉒ 60V-WS853-03




㉑ Yamaha diagnostic system
P/N. 60V-85300-02-00

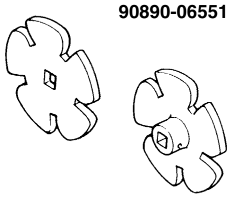
㉒ Yamaha diagnostic system
P/N. 60V-WS853-03

① YB-01426
90890-01426

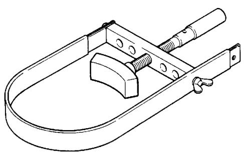


② YW-06551

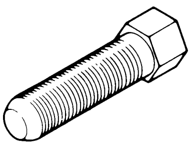
90890-06551



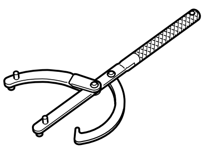
③ YS-01880-A
90890-01701



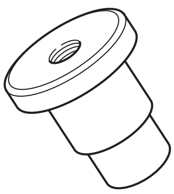
④ YM-01082
90890-01080



⑤ YU-01235
90890-01235



⑥ YB-06111



## REMOVAL AND INSTALLATION

① Oil filter wrench
P/N. YB-01426
90890-01426

② Coupler wrench
P/N. YW-06551
90890-06551

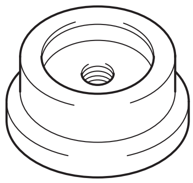
③ Sheave holder
P/N. YS-01880-A
90890-01701

④ Rotor puller
P/N. YM-01082
90890-01080

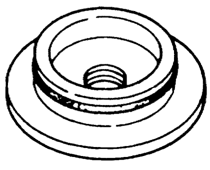
⑤ Universal magneto and rotor holder
P/N. YU-01235
Rotor holder
P/N. 90890-01235

⑥ Bearing housing needle bearing installer
(reduction drive gear)
P/N. YB-06111

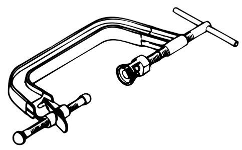
⑦ YB-06276-B



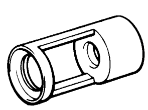
⑧ 90890-06657



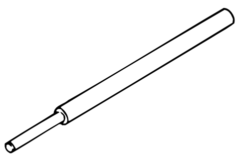
⑨ YM-01253
90890-04019



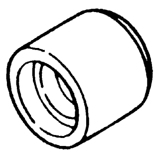
⑩ YM-04114 (ø19 mm)
90890-04114 (ø19 mm)
YM-04108 (ø22 mm)
90890-04108 (ø22 mm)



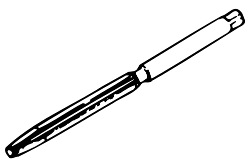
⑪ YM-04111 (ø4.0 mm)
90890-04111 (ø4.0 mm)
YM-04116 (ø4.5 mm)
90890-04116 (ø4.5 mm)



⑫ YM-04112 (ø4.0 mm)
90890-04112 (ø4.0 mm)
YM-04117 (ø4.5 mm)
90890-04117 (ø4.5 mm)

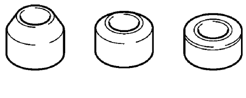


⑬ YM-04113 (ø4.0 mm)
90890-04113 (ø4.0 mm)
YM-04118 (ø4.5 mm)
90890-04118 (ø4.5 mm)



⑭ 90890-06813 (60°)
90890-06814 (45°)
90890-06815 (30°)

90890-06315 (60°)
90890-06312 (45°)
90890-06328 (30°)



⑦ Forward gear bearing cup installer
(reduction drive gear)
P/N. YB-06276-B

⑧ Ball bearing attachment
(reduction drive gear)
P/N. 90890-06657

⑨ Valve spring compressor
P/N. YM-01253
90890-04019

⑩ Valve spring compressor attachment
P/N. YM-04114 (ø19 mm)
90890-04114 (ø19 mm)
YM-04108 (ø22 mm)
90890-04108 (ø22 mm)

⑪ Valve guide remover
P/N. YM-04111 (ø4.0 mm)
90890-04111 (ø4.0 mm)
YM-04116 (ø4.5 mm)
90890-04116 (ø4.5 mm)

⑫ Valve guide installer
P/N. YM-04112 (ø4.0 mm)
90890-04112 (ø4.0 mm)
YM-04117 (ø4.5 mm)
90890-04117 (ø4.5 mm)

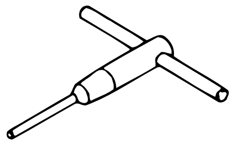
⑬ Valve guide reamer
P/N. YM-04113 (ø4.0 mm)
90890-04113 (ø4.0 mm)
YM-04118 (ø4.5 mm)
90890-04118 (ø4.5 mm)

⑭ Valve seat cutter
Intake
P/N. 90890-06813 (60°)
90890-06814 (45°)
90890-06815 (30°)
Exhaust
P/N. 90890-06315 (60°)
90890-06312 (45°)
90890-06328 (30°)

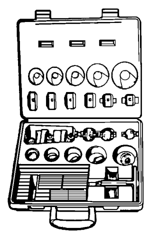
## SPECIAL SERVICE TOOLS



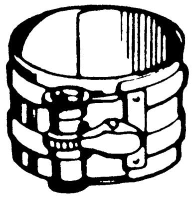
⑮ 90890-06811 (ø4.0 mm)
90890-06812 (ø4.5 mm)



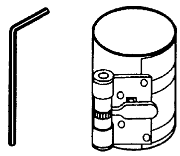
⑯ YM-91044



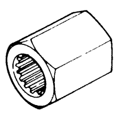
⑰ YM-08037



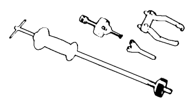
90890-05158



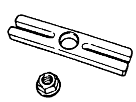
⑱ YB-06151
90890-06519



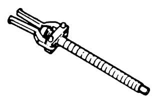
⑲ YB-06096



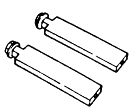
⑳ 90890-06501



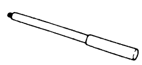
㉑ 90890-06535



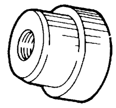
㉒ 90890-06538



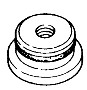
㉓ 90890-06652



㉔ YB-06112



㉕ 90890-06614
90890-06653
90890-06634



⑮ Valve seat cutter holder
P/N. 90890-06811 (ø4.0 mm)
90890-06812 (ø4.5 mm)

⑯ Neway valve seat cutter kit
P/N. YM-91044

⑰ Piston ring compressor
P/N. YM-08037
90890-05158

⑱ Drive shaft holder (impeller)
P/N. YB-06151
Drive shaft holder 5 (impeller)
P/N. 90890-06519

⑲ Slide hammer and adapters
(jet pump bearing and reduction drive gear)
P/N. YB-06096

⑳ Stopper guide plate (jet pump bearing)
P/N. 90890-06501

㉑ Bearing puller assembly
(jet pump bearing and reduction drive gear)
P/N. 90890-06535

㉒ Stopper guide stand
(jet pump bearing and reduction drive gear)
P/N. 90890-06538

㉓ Driver rod L3
(jet pump bearing and reduction drive gear)
P/N. 90890-06652

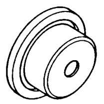
㉔ Bearing housing needle bearing remover
(jet pump bearing)
P/N. YB-06112

㉕ Needle bearing attachment
(jet pump bearing, oil seal, and reduction drive gear)
P/N. 90890-06614, 90890-06653
Ball bearing attachment
(jet pump oil seal)
P/N. 90890-06634

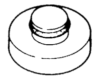
# SPECIAL SERVICE TOOLS



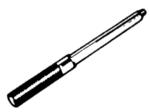
㉖ YB-06085



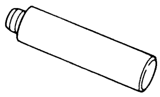
㉗ 90890-06631



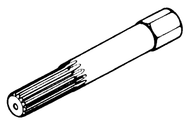
㉘ YB-06071



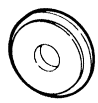
㉙ 90890-06606



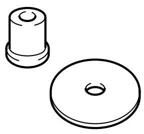
㉚ YB-06552
90890-06552



㉛ YB-06156 90890-06624
90890-06626



㉜ YB-06432



㉖ Outer race installer—forward gear
(jet pump oil seal and reduction drive gear)
P/N. YB-06085

㉗ Ball bearing attachment
(jet pump oil seal and reduction drive gear)
P/N. 90890-06631

㉘ Driver handle—large
(intermediate shaft, jet pump, and reduction drive gear)
P/N. YB-06071

㉙ Driver rod LS
(intermediate shaft, jet pump, and reduction drive gear)
P/N. 90890-06606

㉚ Crankshaft holder (intermediate shaft)
P/N. YB-06552
Crankshaft holder 20 (intermediate shaft)
P/N. 90890-06552

㉛ Bearing outer race attachment
(intermediate shaft and reduction drive gear)
P/N. 90890-06624, 90890-06628

㉜ Roller bearing installer/remover
(intermediate shaft bearing and oil seals)
P/N. YB-06432

# CHAPTER 2
# SPECIFICATIONS

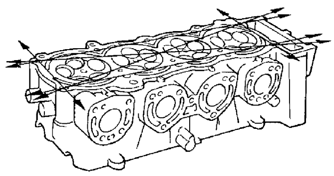
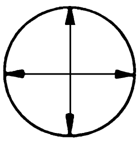
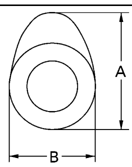
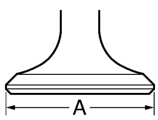
# GENERAL SPECIFICATIONS

| Item | Unit | Model | |
|---|---|---|---|
| | | VX110 Sport | VX110 Deluxe |
| Model code | | | |
| Hull | | F1K | |
| Engine/jet | | 6D3 | |
| Dimensions | | | |
| Length | mm (in) | 3,220 (126.8) | |
| Width | mm (in) | 1,170 (46.1) | |
| Height | mm (in) | 1,150 (45.3) | |
| Dry weight | kg (lb) | 325 (716) | |
| Maximum capacity | Person/kg (lb) | 3/240 (530) | |
| Performance | | | |
| Maximum output | kW (PS) @ r/min | 81.0 (110) @ 8,000 | |
| Maximum fuel consumption | l/h (US gal/h, Imp gal/h) | 28.0 (7.4, 6.2) | |
| Cruising range | h | 2.1 | |
| Engine | | | |
| Engine type | | 4-stroke, L4, DOHC | |
| Displacement | $cm^3$ (cu. in) | 1,052 (64.2) | |
| Bore × stroke | mm (in) | 76.0 × 58.0 (2.99 × 2.28) | |
| Compression ratio | | 11.4:1 | |
| Exhaust system | | Wet exhaust | |
| Lubrication system | | Dry sump | |
| Cooling system | | Water cooled | |
| Starting system | | Electric starter | |
| Ignition system | | TCI | |
| Ignition timing | Degree | BTDC 5–BTDC 35 | |
| Spark plug model (manufacturer) | | CR9EB (NGK) | |
| Spark plug gap | mm (in) | 0.7–0.8 (0.028–0.031) | |
| Battery capacity | V/Ah | 12/19 | |
| Generator output | A @ r/min | 12–21 @ 6,000 | |
| Drive unit | | | |
| Propulsion system | | Jet pump | |
| Jet pump type | | Axial flow, single stage | |
| Impeller rotation | | Counterclockwise (viewed from rear) | |
| Transmission | | Constant mesh 1-speed | |
| Jet thrust nozzle horizontal angle | Degree | 24 + 24 | |
| Jet thrust nozzle trim angle | Degree | 3 | |
| Reverse system | | — | Reverse gate |

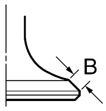
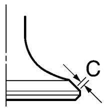
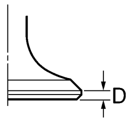
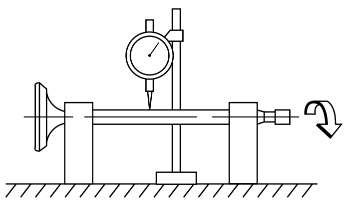
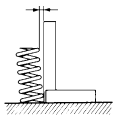
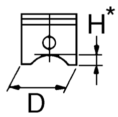
| Item | Unit | Model | |
|---|---|---|---|
| | | VX110 Sport | VX110 Deluxe |
| Fuel and oil | | | |
| Fuel type | | Regular unleaded gasoline | |
| Minimum fuel rating | PON* | 86 | |
| | RON* | 90 | |
| Fuel tank capacity | L (US gal, Imp gal) | 60 (15.9, 13.2) | |
| Engine oil type | | 4-stroke motor oil | |
| Engine oil grade | API | SE, SF, SG, SH, SJ, SL | |
| | SAE | 10W-30, 20W-40, 20W-50 | |
| Engine oil quantity | L (US qt, Imp qt) | 4.3 (4.5, 3.8) | |
| (without oil filter replacement) | L (US qt, Imp qt) | 2.0 (2.1, 1.8) | |
| (with oil filter replacement) | L (US qt, Imp qt) | 2.2 (2.3, 1.9) | |

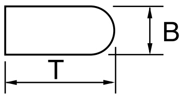
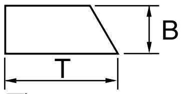
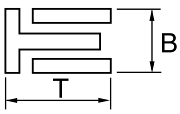
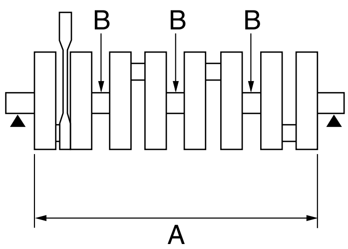
PON*: Pump Octane Number = (Motor Octane Number + Research Octane Number)/2
RON*: Research Octane Number

# MAINTENANCE SPECIFICATIONS
## ENGINE

| Item | Unit | Model | |
|---|---|---|---|
| | | VX110 Sport | VX110 Deluxe |
| Cylinder head | | | |
| Warpage limit | mm (in) | 0.1 (0.004) | |
|  | | | |
| Compression pressure*1 | kPa (kgf/cm², psi) | 1,150 (11.5, 164) | |
| Cylinder  | | | |
| Bore size | mm (in) | 76.000–76.015 (2.9921–2.9927) | |
| Taper limit | mm (in) | 0.08 (0.003) | |
| Out-of-round limit | mm (in) | 0.05 (0.002) | |
| Wear limit | mm (in) | 76.100 (2.9961) | |
| Camshaft  | | | |
| Drive system | | Chain drive | |
| Intake A | mm (in) | 31.15 (1.226) | |
| Exhaust A | mm (in) | 30.75 (1.211) | |
| Intake and exhaust B | mm (in) | 25.00 (0.984) | |
| Camshaft cap inside diameter | mm (in) | 24.5 (0.9646) | |
| Camshaft journal diameter | | | |
| Intake | mm (in) | 24.46–24.47 (0.9630–0.9634) | |
| Exhaust | mm (in) | 24.44–24.45 (0.9622–0.9626) | |
| Camshaft-journal-to-camshaft-cap clearance | mm (in) | 0.05–0.06 (0.0020–0.0024) | |
| Maximum camshaft runout | mm (in) | 0.03 (0.0012) | |
| Timing chain | | | |
| Model/number of links | | 92RH2015-130/130 | |
| Tensioning system | | Automatic | |
| Valves, valve seats, valve guides | | | |
| Valve clearance (cold) | | | |
| Intake | mm (in) | 0.11–0.20 (0.0043–0.0079) | |
| Exhaust | mm (in) | 0.25–0.34 (0.0098–0.0134) | |
| Valve dimensions | | | |
| Valve head diameter A | | | |
| Intake | mm (in) | 22.9–23.1 (0.9016–0.9094) | |
| Exhaust  | mm (in) | 24.4–24.6 (0.9606–0.9685) | |

*1 Measuring conditions:
Ambient temperature 20 °C (68 °F), wide open throttle, with spark plugs removed from all cylinders.
The figures are for reference only.

| Item | Unit | Model | |
|---|---|---|---|
| | | VX110 Sport | VX110 Deluxe |
| Valve face width B  | | | |
| Intake | mm (in) | 1.91–2.64 (0.0752–0.1039) | |
| Exhaust | mm (in) | 1.91–2.64 (0.0752–0.1039) | |
| Valve seat width C  | | | |
| Intake | mm (in) | 0.90–1.10 (0.0354–0.0433) | |
| Exhaust | mm (in) | 0.90–1.10 (0.0354–0.0433) | |
| Valve margin thickness D  | | | |
| Intake | mm (in) | 0.85–1.15 (0.0335–0.0453) | |
| Exhaust | mm (in) | 0.85–1.15 (0.0335–0.0453) | |
| Valve stem diameter | | | |
| Intake | mm (in) | 3.975–3.990 (0.1565–0.1571) | |
| Exhaust | mm (in) | 4.465–4.480 (0.1758–0.1764) | |
| Valve guide inside diameter | | | |
| Intake | mm (in) | 4.000–4.012 (0.1575–0.1580) | |
| Exhaust | mm (in) | 4.500–4.512 (0.1772–0.1776) | |
| Valve-stem-to-valve-guide clearance | | | |
| Intake | mm (in) | 0.010–0.037 (0.0004–0.0015) | |
| Exhaust | mm (in) | 0.020–0.047 (0.0008–0.0019) | |
| Valve stem runout  | mm (in) | 0.01 (0.0004) | |
| Valve spring | | | |
| Free length | | | |
| Intake | mm (in) | 38.90 (1.53) | |
| Exhaust | mm (in) | 40.67 (1.60) | |
| Installed length | | | |
| Intake | mm (in) | 34.50 (1.36) | |
| Exhaust | mm (in) | 35.00 (1.38) | |
| Tilt limit  | | | |
| Intake | Degree/mm (in) | 2.5/1.7 (0.067) | |
| Exhaust | Degree/mm (in) | 2.5/1.8 (0.071) | |
| Piston | | | |
| Piston-to-cylinder clearance | mm (in) | 0.10–0.11 (0.0039–0.0043) | |
| Piston diameter  | mm (in) | 75.895–75.910 (2.9880–2.9886) | |
| Measuring point H* | mm (in) | 5 (0.2) | |
| Wear limit | mm (in) | 0.170 (0.0067) | |
| Piston pin boss inside diameter | mm (in) | 17.002–17.013 (0.6694–0.6698) | |

| Item | Unit | Model | |
|---|---|---|---|
| | | VX110 Sport | VX110 Deluxe |
| **Piston pins** | | | |
| Outside diameter | mm (in) | 16.991–17.000 (0.6689–0.6693) | |
| Wear limit | mm (in) | 16.986 (0.6687) | |
| **Piston ring** | | | |
| Top ring   | | | |
| Type | | Barrel | |
| Dimension (B × T) | mm (in) | 0.90 × 2.75 (0.04 × 0.11) | |
| End gap (installed) | mm (in) | 0.32–0.44 (0.0126–0.0173) | |
| Ring groove clearance | mm (in) | 0.030–0.065 (0.0012–0.0026) | |
| 2nd ring   | | | |
| Type | | Taper | |
| Dimensions (B × T) | mm (in) | 0.80 × 2.80 (0.03 × 0.11) | |
| End gap (installed) | mm (in) | 0.43–0.58 (0.0169–0.0228) | |
| Ring groove clearance | mm (in) | 0.020–0.055 (0.0008–0.0022) | |
| Oil ring   | | | |
| Dimensions (B × T) | mm (in) | 1.50 × 2.60 (0.06 × 0.10) | |
| End gap (installed) | mm (in) | 0.10–0.35 (0.0039–0.0138) | |
| Ring groove clearance | mm (in) | 0.040–0.160 (0.0016–0.0063) | |
| **Connecting rod** | | | |
| Big end oil clearance | mm (in) | 0.016–0.040 (0.0006–0.0016) | |
| Bearing color code | | 1. Brown 2. Black 3. Blue 4. Green | |
| Small end inside diameter | mm (in) | 17.005–17.018 (0.6695–0.6700) | |
| **Crankshaft**   | | | |
| Crank width A | mm (in) | 304.8–306.0 (12.00–12.05) | |
| Deflection limit B | mm (in) | 0.03 (0.0012) | |
| Crankshaft journal oil clearance | mm (in) | 0.004–0.028 (0.0002–0.0011) | |
| Bearing color code | | 3. Red/Red 4. Red/Brown 5. Red/Black 6. Red/Blue 7. Red/Green | |
| **Throttle body** | | | |
| Type/quantity | | IM-230/1 | |
| Manufacturer | | Mikuni | |
| ID mark | | 6D300 | |
| Trolling speed | r/min | 1,550–1,750 | |

| Item | Unit | Model | |
|---|---|---|---|
| | | VX110 Sport | VX110 Deluxe |
| Fuel pump | | | |
| Pump type | | Electrical | |
| Fuel pressure | kPa ($kgf/cm^2$, psi) | 320–327 (3.2–3.3, 46–47) | |
| Oil filter | | | |
| Oil filter type | | Cartridge type | |
| Oil pump | | | |
| Oil pump type | | Trochoid | |
| Rotor tip clearance (scavenge pump) | mm (in) | 0.09–0.15 (0.0035–0.0059) | |
| Oil pump housing clearance | | | |
| Rotor (feed pump) | mm (in) | 0.09–0.17 (0.0035–0.0067) | |
| Rotor (scavenge pump) | mm (in) | 0.09–0.15 (0.0035–0.0059) | |

## JET PUMP UNIT

| Item | Unit | Model | |
|---|---|---|---|
| | | VX110 Sport | VX110 Deluxe |
| Jet pump | | | |
| Impeller material | | Stainless steel | |
| Number of impeller blades | | 3 | |
| Impeller pitch angle | Degree | 21.2 | |
| Impeller clearance | mm (in) | 0.35–0.45 (0.0138–0.0177) | |
| Impeller clearance limit | mm (in) | 0.6 (0.0236) | |
| Drive shaft runout limit | mm (in) | 0.3 (0.0118) | |

## HULL AND HOOD

| Item | Unit | Model | |
|---|---|---|---|
| | | VX110 Sport | VX110 Deluxe |
| Free play | | | |
| Throttle lever free play | mm (in) | 4–7 (0.16–0.28) | |

## ELECTRICAL

| Item | Unit | Model | |
|---|---|---|---|
| | | VX110 Sport | VX110 Deluxe |
| Battery | | | |
| Type | | Fluid | |
| Capacity | V/Ah | 12/19 | |
| Specific gravity | | 1.28 | |
| ECM unit (B/R – R/Y, B/W – R/Y, B/Y – R/Y, B/G – R/Y) | | | |
| Output peak voltage lower limit | | | |
| @cranking (loaded) | V | 90 | |
| @2,000 r/min (loaded) | V | 130 | |
| @3,500 r/min (loaded) | V | 140 | |
| Stator | | | |
| Pickup coil (W/B – B/O) | | | |
| Output peak voltage | | | |
| @cranking (unloaded) | V | 8.0 | |
| @cranking (loaded) | V | 6.9 | |
| @2,000 r/min (loaded) | V | 19.4 | |
| @3,500 r/min (loaded) | V | 25.1 | |
| Lighting coil (G – G) | | | |
| Output peak voltage | | | |
| @cranking (unloaded) | V | 7.8 | |
| @2,000 r/min (unloaded) | V | 24.5 | |
| @3,500 r/min (unloaded) | V | 41.6 | |
| Pickup coil resistance (W/B – B/O) | Ω (color) | 459–561 | |
| Lighting coil resistance (G – G) | Ω (color) | 0.23–0.29 | |
| Minimum charging current | A @ r/min | 14 @ 6,000 | |
| Ignition coil | | | |
| Primary coil resistance @20 °C (68 °F) | Ω | 1.19–1.61 | |
| Secondary coil resistance @20 °C (68 °F) | kΩ | 8.5–11.5 | |
| Rectifier/regulator (R – B) | | | |
| Output peak voltage | | | |
| @3,500 r/min (unloaded) | V | 13.0 | |

| Item | Unit | Model | |
|---|---|---|---|
| | | VX110 Sport | VX110 Deluxe |
| Starter motor | | | |
| Type | | Constant mesh | |
| Output | kW | 0.8 | |
| Rating | Seconds | 30 | |
| Brush length | mm (in) | 12.5 (0.49) | |
| Wear limit | mm (in) | 6.5 (0.26) | |
| Commutator undercut | mm (in) | 0.7 (0.03) | |
| Limit | mm (in) | 0.2 (0.01) | |
| Commutator diameter | mm (in) | 28.0 (1.10) | |
| Limit | mm (in) | 27.0 (1.06) | |
| Starter relay | | | |
| Rating | Seconds | 30 | |
| Thermoswitch | | | |
| ON temperature (engine) | °C (°F) | 84–90 (183–194) | |
| OFF temperature (engine) | °C (°F) | 70–84 (158–183) | |
| ON temperature (exhaust) | °C (°F) | 80–86 (176–187) | |
| OFF temperature (exhaust) | °C (°F) | 66–80 (151–176) | |
| Engine temperature sensor | | | |
| Engine temperature sensor resistance (B/Y – B/Y) | | | |
| @ 20 °C (68 °F) | kΩ | 54.2–69.0 | |
| @ 100 °C (212 °F) | kΩ | 3.12–3.48 | |
| Speed sensor | | | |
| Output voltage (on pulse) | V | 11.6 | |
| Output pulse/one full turn | | 2 | |
| Throttle position sensor | | | |
| Output voltage | | | |
| @ throttle valve fully closed | | | |
| Sensor 1 | V | 0.45–0.95 | |
| @ throttle valve fully opened | | | |
| Sensor 2 | V | 4.60–4.70 | |
| Accelerator position sensor | | | |
| Output voltage | | | |
| @ throttle lever fully closed | | | |
| Sensor 1 | V | 0.50–0.90 | |
| Sensor 2 | V | 0.35–1.05 | |
| @ throttle lever fully opened | | | |
| Sensor 1 | V | 3.75–4.35 | |
| Sensor 2 | V | 3.50–4.50 | |

| Item | Unit | Model | |
|---|---|---|---|
| | | VX110 Sport | VX110 Deluxe |
| Accelerator position sensor resistance*1 | | | |
| @ throttle lever fully closed | | | |
| Sensor 1 | kΩ | 0.50–0.90 | |
| Sensor 2 | kΩ | 0.35–10.50 | |
| @ throttle lever fully opened | | | |
| Sensor 1 | kΩ | 3.75–4.35 | |
| Sensor 2 | kΩ | 3.60–4.50 | |
| Cam position sensor | | | |
| Output voltage (G/O – B/O) | | | |
| Position A | V | More than 4.8 | |
| Position B | V | Less than 0.8 | |
| Position C | V | More than 4.8 | |
| Fuel sender | | | |
| Fuel sender resistance | | | |
| Position A | Ω | 133.5–136.5 | |
| Position B | Ω | 5–7 | |
| Oil pressure switch | | | |
| Oil pressure switch continuity pressure | kPa ($kgf/cm^2$, psi) | 128 (1.28, 18.2)–167 (1.67, 23.8) | |
| Fuel injector | | | |
| Fuel injector resistance*1 | | | |
| @ 20 °C (68 °F) | Ω | 11.5–12.5 | |
| Fuse | | | |
| Rating | | | |
| Main | V/A | 12/30 | |
| Main and fuel pump relay | V/A | 12/20 | |
| Main and fuel pump relay | V/A | 12/10 | |
| Electronic control throttle valve relay | V/A | 12/10 | |
| Remote control unit (Deluxe model only) | V/A | 12/3 | |

*1: The figures are for reference only.

# TIGHTENING TORQUES
## SPECIFIED TORQUES

| Part to tightened | | Part name | Thread size | Q'ty | Tightening torque | | | Remarks | Refer to page |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | N•m | kgf•m | ft•lb | | |
| **Fuel system** | | | | | | | | | |
| Retainer/fuel pump module | 1st | Nut | — | 9 | 3.2 | 0.32 | 2.3 | | 4-1 |
| | 2nd | | | | 6.4 | 0.64 | 4.6 | | |
| Fuel filler neck/rubber seal | | Nut | — | 1 | 5.9 | 0.59 | 4.3 | | 4-1 |
| Fuel filter hose clamp | | — | — | 2 | 3.7 | 0.37 | 2.7 | | 4-1 |
| Air filter case cover | | Screw | M5 | 2 | 1.2 | 0.12 | 0.9 | LT 572 | 4-7 |
| | | | | 4 | 1.5 | 0.15 | 1.1 | | |
| Air filter case | | Bolt | M8 | 4 | 17 | 1.7 | 12 | | 4-7 |
| Air filter case bracket | | Nut | — | 4 | 15 | 1.5 | 11 | | 4-7 |
| Air intake hose clamp | | — | — | 1 | 2.5 | 0.25 | 1.8 | | 4-7 |
| Throttle cable | | Nut | — | 1 | 6.5 | 0.65 | 4.7 | | 4-7 |
| Accelerator position sensor | | Nut | — | 2 | 17 | 1.7 | 12 | | 4-7 |
| Throttle body assembly | | Bolt | M8 | 4 | 13 | 1.3 | 9.4 | | 4-10 |
| Intake manifold | 1st | Bolt | M6 | 2 | 8.8 | 0.88 | 6.4 | LT 242 | 4-7 |
| | 2nd | | | | 18 | 1.8 | 13 | | |
| Intake manifold bracket/ wiring harness bracket 1 | 1st | Bolt | M8 | 2 | 15 | 1.5 | 11 | LT 271 | 4-7 |
| | 2nd | | | | 39 | 3.9 | 28 | | |
| Fuel rail | | Bolt | M8 | 2 | 13 | 1.3 | 9.4 | | 4-10 |
| Sensor assembly | | Screw | M5 | 2 | 3.5 | 0.35 | 2.5 | | 4-10 |
| **Engine** | | | | | | | | | |
| Engine unit | | Bolt | M8 | 4 | 17 | 1.7 | 12 | LT 271 | 5-1 |
| Oil filter | | — | — | 1 | 17 | 1.7 | 12 | E | 3-17 |
| Coupling cover | | Bolt | M6 | 1 | 7.8 | 0.78 | 5.6 | LT 572 | 5-1 |
| Thermoswitch (exhaust) | | Bolt | M6 | 2 | 7.6 | 0.76 | 5.5 | LT 572 | 5-8 |
| Outer exhaust joint clamp | 1st | — | — | 2 | 3.4 | 0.34 | 2.5 | | 5-8 |
| | 2nd | | | | 3.4 | 0.34 | 2.5 | | |
| Inner exhaust joint clamp | 1st | — | — | 2 | 3.4 | 0.34 | 2.5 | | 5-8 |
| | 2nd | | | | 3.4 | 0.34 | 2.5 | | |
| Exhaust pipe 2*1 | 1st | Bolt | M10 | 4 | 2.0 | 0.2 | 1.4 | LT 242 | 5-9 |
| | 2nd | | | | 15 | 1.5 | 11 | | |
| | 3rd | | | | 39 | 3.9 | 28 | | |
| Exhaust pipe end | 1st | Bolt | M6 | 3 | 3.7 | 0.37 | 2.7 | LT 572 | 5-10 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | | |
| Exhaust pipe 1 | 1st | Bolt | M8 | 4 | 22 | 2.2 | 16 | LT 242 | 5-10 |
| | 2nd | | | | 22 | 2.2 | 16 | | |
| | 3rd | | | | 35 | 3.5 | 25 | | |
| Exhaust manifold | 1st | Bolt | M8 | 11 | 22 | 2.2 | 16 | LT 242 | 5-11 |
| | 2nd | | | | 22 | 2.2 | 16 | | |
| | 3rd | | | | 35 | 3.5 | 25 | | |

*1: For details, refer to the tightening procedures in this manual.

## TIGHTENING TORQUES



| Part to tightened | | Part name | Thread size | Q'ty | Tightening torque | | | Remarks | Refer to page |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | N•m | kgf•m | ft•lb | | |
| Oil separator | 1st | Bolt | M6 | 2 | 3.7 | 0.37 | 2.7 | LT 572 | 5-12 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | | |
| Ground lead box | | Bolt | M6 | 3 | 7.6 | 0.76 | 5.5 | LT 572 | 5-12 |
| Oil tank | 1st | Bolt | M10 | 5 | 15 | 1.5 | 11 | LT 572 | 5-12 |
| | 2nd | | | | 39 | 3.9 | 28 | | |
| Plastic tie/collar | 1st | Bolt | M6 | 1 | 3.7 | 0.37 | 2.7 | | 5-12 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | | |
| Oil tank | 1st | Nut | — | 2 | 2.0 | 0.2 | 1.4 | | 5-12 |
| | 2nd | | | | 15 | 1.5 | 11 | | |
| | 3rd | | | | 39 | 3.9 | 28 | | |
| Oil tank stay | 1st | Bolt | M10 | 2 | 2.0 | 0.2 | 1.4 | LT 572 | 5-12 |
| | 2nd | | | | 15 | 1.5 | 11 | | |
| | 3rd | | | | 39 | 3.9 | 28 | | |
| Bracket (coupling cover) | 1st | Bolt | M6 | 2 | 3.7 | 0.37 | 2.7 | LT 572 | 5-15 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | | |
| Oil tank cover | 1st | Bolt | M6 | 8 | 3.7 | 0.37 | 2.7 | LT 572 | 5-15 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | | |
| Oil breather plate | 1st | Bolt | M5 | 9 | 1.9 | 0.19 | 1.4 | E | 5-15 |
| | 2nd | | | | 4.4 | 0.44 | 3.2 | | |
| Baffle plate | 1st | Bolt | M5 | 3 | 1.9 | 0.19 | 1.4 | E | 5-15 |
| | 2nd | | | | 4.4 | 0.44 | 3.2 | | |
| Oil strainer | 1st | Bolt | M6 | 2 | 3.7 | 0.37 | 2.7 | E | 5-15 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | | |
| Oil cooler cover | 1st | Bolt | M6 | 24 | 3.7 | 0.37 | 2.7 | LT 572 | 5-15 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | | |
| Anode | | Screw | M4 | 1 | 3.8 | 0.38 | 2.7 | E | 5-15 |
| Oil pump assembly | | Bolt | M6 | 6 | 10 | 1.0 | 7.2 | LT 572 | 5-21 |
| | 1st | | M8 | 4 | 15 | 1.5 | 11 | | |
| | 2nd | | | | 28 | 2.8 | 20 | | |
| Drain plug (engine oil) | | Bolt | M8 | 1 | 13 | 1.3 | 9.4 | | 5-21 |
| Strainer | 1st | Bolt | M6 | 2 | 3.7 | 0.37 | 2.7 | | 5-21 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | | |
| Drive coupling | | — | — | 1 | 28 | 2.8 | 20 | LT 572 | 5-24 |
| Reduction drive gear case | 1st | Bolt | M6 | 2 | 3.7 | 0.37 | 2.7 | LT 572 | 5-24 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | | |
| | 1st | Bolt | M8 | 5 | 15 | 1.5 | 11 | LT 572 | 5-24 |
| | 2nd | | | | 28 | 2.8 | 20 | | |
| Starter motor lead | | Nut | — | 1 | 4.9 | 0.49 | 3.5 | A | 5-33 |
| Starter motor | | Bolt | M8 | 2 | 18 | 1.8 | 13 | | 5-33 |
| Generator cover | 1st | Bolt | M10 | 8 | 15 | 1.5 | 11 | LT 572 | 5-33 |
| | 2nd | | | | 50 | 5.0 | 36 | | |
| Flywheel magneto | | Bolt | M10 | 1 | 75 | 7.5 | 54 | E | 5-33 |
| Starter clutch | | Bolt | M8 | 6 | 24 | 2.4 | 17 | | 5-33 |

| Part to tightened | | Part name | Thread size | Q'ty | Tightening torque N•m | kgf•m | ft•lb | Remarks | Refer to page |
|---|---|---|---|---|---|---|---|---|---|
| Washer/pickup coil lead and lighting coil lead | | Bolt | M5 | 1 | 4.9 | 0.49 | 3.5 | LT 242 | 5-36 |
| Pickup coil | | Bolt | M5 | 2 | 4.9 | 0.49 | 3.5 | LT 242 | 5-36 |
| Holder (wiring harness) | | Bolt | M6 | 2 | 14 | 1.4 | 10 | LT 242 | 5-36 |
| Lighting coil | | Bolt | M6 | 3 | 14 | 1.4 | 10 | LT 242 | 5-36 |
| Spark plug | | — | — | 4 | 13 | 1.3 | 9.4 | | 5-41 |
| Ignition coil | | Bolt | M6 | 4 | 7.6 | 0.76 | 5.5 | LT 572 | 5-41 |
| Cam position sensor | | Bolt | M6 | 1 | 10 | 1.0 | 7.2 | LT 572 | 5-41 |
| Cooling water pipe | 1st | Bolt | M6 | 1 | 3.7 | 0.37 | 2.7 | | 5-41 |
| | 2nd | | | | 7.6 | 0.76 | 5.5 | | |
| Cylinder head cover | | Bolt | M6 | 6 | 12 | 1.2 | 8.7 | E | 5-41 |
| Timing chain tensioner cap bolt | | Bolt | M6 | 1 | 10 | 1.0 | 7.2 | | 5-43 |
| Timing chain tensioner | | Bolt | M6 | 2 | 10 | 1.0 | 7.2 | | 5-43 |
| Exhaust camshaft cap | | Bolt | M6 | 10 | 10 | 1.0 | 7.2 | E | 5-43 |
| Intake camshaft cap | | Bolt | M6 | 18 | 10 | 1.0 | 7.2 | E | 5-43 |
| Exhaust camshaft sprocket | | Bolt | M7 | 2 | 24 | 2.4 | 17 | E | 5-43 |
| Intake camshaft sprocket | | Bolt | M7 | 2 | 24 | 2.4 | 17 | E | 5-43 |
| Cylinder head*1 | | Bolt | M6 | 3 | 10 | 1.0 | 7.2 | E | 5-54 |
| | 1st | Nut | — | 2 | 20 | 2.0 | 14 | E | 5-54 |
| | 2nd | | | | 140 ± 5° | | | | |
| | 1st | Nut | — | 3 | 20 | 2.0 | 14 | E | 5-54 |
| | 2nd | | | | 121 ± 5° | | | | |
| | 1st | Nut | — | 5 | 20 | 2.0 | 14 | E | 5-54 |
| | 2nd | | | | 105 ± 5° | | | | |
| Engine temperature sensor | | — | — | 1 | 15 | 1.5 | 11 | | 5-71 |
| Thermoswitch (engine) | | Bolt | M6 | 2 | 7.6 | 0.76 | 5.5 | LT 572 | 5-71 |
| Oil pressure switch | | — | — | 1 | 8.4 | 0.84 | 6.1 | LT 572 | 5-71 |
| Anode cover | | Bolt | M6 | 1 | 12 | 1.2 | 8.7 | LT 271 | 5-71 |
| | | | M8 | | 20 | 2.0 | 14 | | |
| Oil pan | | Bolt | M6 | 15 | 12 | 1.2 | 8.7 | LT 572 | 5-71 |
| Lower crankcase | | Bolt | M6 | 10 | 12 | 1.2 | 8.7 | LT 572 | 5-71 |
| | 1st | Bolt | M9 | 10 | 7.8 | 0.78 | 5.6 | E | 5-71 |
| | 2nd | | | | Loosen completely | | | | |
| | 3rd | | | | 15 | 1.5 | 11 | | |
| | 4th | | | | 49 ± 5° | | | | |
| Oil pipe | | Bolt | M6 | 1 | 12 | 1.2 | 8.7 | E | 5-74 |
| Oil filter bolt | | — | — | 1 | 35 | 3.5 | 25 | E | 5-74 |
| Connecting rod cap | 1st | Nut | — | 8 | 20 | 2.0 | 14 | M | 5-80 |
| | 2nd | | | | 120 ± 5° | | | | |

*1: For details, refer to the tightening procedures in this manual.

# TIGHTENING TORQUES

| Part to tightened | Part name | Thread size | Q'ty | Tightening torque | | | Remarks | Refer to page |
|---|---|---|---|---|---|---|---|---|
| | | | | N•m | kgf•m | ft•lb | | |
| **Jet pump unit** | | | | | | | | |
| Steering cable joint | Nut | — | 1 | 6.8 | 0.68 | 4.9 | LT 242 | 6-3 |
| Ride plate | Bolt | M8 | 4 | 17 | 1.7 | 12 | LT 572 | 6-1 |
| Intake grate | Bolt | M6 | 2 | 7.6 | 0.76 | 5.5 | LT 242 | 6-1 |
| | | M10 | | 40 | 4.0 | 29 | | |
| Speed sensor | Screw | M5 | 4 | 3.7 | 0.37 | 2.7 | LT 242 | 6-1 |
| Jet pump unit assembly | Bolt | M6 | 1 | 7.8 | 0.78 | 5.6 | LT 572 | 6-3 |
| | | M10 | 4 | 40 | 4.0 | 29 | | |
| Rubber plate | Bolt | M6 | 4 | 6.8 | 0.68 | 4.9 | | 6-3 |
| | Nut | — | 2 | | | | | |
| Bracket | Bolt | M8 | 2 | 17 | 1.7 | 12 | | 6-3 |
| | | | | 14 | 1.4 | 10 | LT 271 | |
| Reverse gate | Bolt | M8 | 2 | 15 | 1.5 | 11 | LT 271 | 6-5 |
| Reverse gate ball joint | Nut | — | 1 | 7.8 | 0.78 | 5.6 | LT 242 | 6-5 |
| Reverse gate spring | Nut | — | 1 | 7.8 | 0.78 | 5.6 | LT 242 | 6-5 |
| Spout hose clamp | — | — | 1 | 1.2 | 0.12 | 0.9 | | 6-5 |
| | | | 1 | 2.2 | 0.22 | 1.6 | | 6-3 |
| Jet thrust nozzle | Bolt | M8 | 2 | 15 | 1.5 | 11 | LT 271 | 6-6 |
| Nozzle/bracket | Bolt | M10 | 4 | 40 | 4.0 | 29 | LT 572 | 6-6 |
| Water inlet cover/water inlet strainer | Bolt | M6 | 4 | 6.6 | 0.66 | 4.8 | LT 572 | 6-6 |
| Cap | Bolt | M6 | 3 | 7.8 | 0.78 | 5.6 | LT 572 | 6-8 |
| Impeller | Impeller | M22 | 1 | 75 | 7.5 | 54 | LT 572 | 6-8 |
| Transom plate | Nut | — | 4 | 26 | 2.6 | 19 | | 6-15 |
| Intermediate housing cover | Bolt | M8 | 4 | 17 | 1.7 | 12 | LT 271 | 6-18 |
| Driven coupling | Driven coupling | M24 | 1 | 36 | 3.6 | 26 | LT 572 | 6-19 |
| Clamp | — | — | 2 | 4.2 | 0.42 | 3.0 | | 6-18 |
| **Hull and hood** | | | | | | | | |
| Handlebar holder | Bolt | M8 | 4 | 20 | 2.0 | 14 | LT 572 | 8-1 |
| Upper handlebar cover | Screw | M4 | 2 | 1.1 | 0.11 | 0.8 | | 8-1 |
| | | M5 | 4 | 1.1 | 0.11 | 0.8 | | |
| Lower handlebar cover | Screw | M6 | 4 | 3.7 | 0.37 | 2.7 | LT 271 | 8-1 |
| Throttle lever assembly | Screw | M5 | 2 | 3.4 | 0.34 | 2.5 | | 8-4 |
| Handlebar switch assembly | Screw | M5 | 2 | 3.4 | 0.34 | 2.5 | | 8-4 |
| Grip end | Bolt | M5 | 2 | 1.2 | 0.12 | 0.9 | LT 242 | 8-4 |
| Steering column | Bolt | M8 | 4 | 17 | 1.7 | 12 | LT 572 | 8-20 |
| Steering cable ball joint | Ball joint | — | 1 | 6.9 | 0.69 | 5.0 | | 8-20 |
| Steering arm | Bolt | M8 | 1 | 20 | 2.0 | 14 | LT 242 | 8-20 |
| Steering sensor | Bolt | M8 | 4 | 16 | 1.6 | 12 | LT 572 | 8-21 |
| Spacer | Bolt | M8 | 3 | 16 | 1.6 | 12 | LT 572 | 8-21 |
| Shift cable holder (Deluxe model only) | Bolt | M6 | 2 | 6.9 | 0.69 | 5.0 | LT 242 | 8-23 |
| Shift cable seal (Deluxe model only) | Nut | — | 1 | 5.9 | 0.59 | 4.3 | | 8-23 |

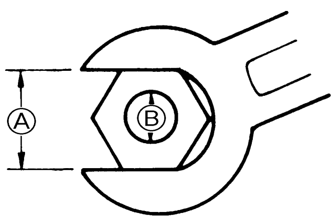
| Part to tightened | Part name | Thread size | Q'ty | Tightening torque | | | Remarks | Refer to page |
|---|---|---|---|---|---|---|---|---|
| | | | | N•m | kgf•m | ft•lb | | |
| Shift cable locknut (Deluxe model only) | Nut | — | 1 | 3.8 | 0.38 | 2.7 | LT 572 | 8-23 |
| Steering cable locknut (steering column side) | Nut | — | 1 | 6.5 | 0.65 | 4.7 | | 8-23 |
| Steering cable locknut (jet pump side) | Nut | — | 1 | 6.8 | 0.68 | 4.9 | LT 572 | 8-23 |
| Steering cable seal | Nut | — | 1 | 5.9 | 0.59 | 4.3 | | 8-23 |
| Steering cable bracket | Bolt | M6 | 1 | 6.9 | 0.69 | 5.0 | LT 572 | 8-23 |
| Speed sensor lead grommet | Nut | — | 1 | 5.9 | 0.59 | 4.3 | | 8-23 |
| Hinge assembly | Bolt | M6 | 2 | 6.9 | 0.69 | 5.0 | | 8-8 |
| Hood lock assembly | Bolt | M5 | 2 | 1.9 | 0.19 | 1.4 | LT 572 | 8-8 |
| Hinge assembly | Bolt | M6 | 4 | 6.9 | 0.69 | 5.0 | LT 242 | 8-8 |
| Lid lock hook | Bolt | M6 | 2 | 6.9 | 0.69 | 5.0 | LT 242 | 8-8 |
| Mirror (Deluxe model only) | Nut | — | 4 | 15 | 1.5 | 11 | | 8-8 |
| Shift handle lever (Deluxe model only) | Screw | M5 | 2 | 3.7 | 0.37 | 2.7 | LT 572 | 8-11 |
| Multifunction meter | Bolt | M5 | 4 | 3.9 | 0.39 | 2.8 | LT 572 | 8-11 |
| Engine hatch cover (Deluxe model only) | Bolt | M6 | 1 | 6.9 | 0.69 | 5.0 | LT 572 | 8-11 |
| Engine hatch cover | Bolt | M6 | 8 | 6.9 | 0.69 | 5.0 | LT 572 | 8-11 |
| Detent plate | Bolt | M6 | 2 | 8.0 | 0.8 | 5.8 | LT 572 | 8-16 |
| Shift lever bracket (Deluxe model only) | Nut | — | 2 | 15 | 1.5 | 11 | | 8-16 |
| Pilot water outlet | Nut | — | 1 | 4.2 | 0.42 | 3.0 | | 8-17 |
| Hand grip | Nut | — | 4 | 6.9 | 0.69 | 5.0 | | 8-28 |
| Seat bracket | Nut | — | 2 | 15 | 1.5 | 11 | | 8-28 |
| Seat lock projection | Bolt | — | 1 | 26 | 2.6 | 19 | | 8-28 |
| Seat lock assembly | Bolt | M6 | 2 | 6.4 | 0.64 | 4.6 | LT 271 | 8-28 |
| Plate/rubber hose/exhaust valve | Nut | — | 6 | 5.4 | 0.54 | 3.9 | | 8-31 |
| Hose clamp 1 | — | — | 2 | 3.7 | 0.37 | 2.7 | | 8-31 |
| Hose clamp 2 | — | — | 1 | 3.7 | 0.37 | 2.7 | | 8-31 |
| Joint clamp 1 and 4 | — | — | 2 | 3.7 | 0.37 | 2.7 | | 8-31 |
| Joint clamp 2 and 3 — 1st | — | — | 2 | 2.4 | 0.24 | 1.7 | | 8-31 |
| Joint clamp 2 and 3 — 2nd | | | | 2.4 | 0.24 | 1.7 | | |
| Sponson | Bolt | M8 | 10 | 16 | 1.6 | 12 | LT 572 | 8-36 |
| Cleat | Nut | — | 2<br>4 | 15 | 1.5 | 11 | | 8-36 |
| Spout | Nut | — | 1 | 5.4 | 0.54 | 3.9 | | 8-36 |
| Protector (bow) | Nut | — | 5 | 6.9 | 0.69 | 5.0 | | 8-36 |
| Bow eye | Bolt | M6 | 2 | 13 | 1.3 | 9.4 | | 8-36 |
| Drain plug/packing | Screw | M5 | 4 | 2.0 | 0.2 | 1.4 | | 8-36 |
| Engine mount | Bolt | M8 | 8 | 17 | 1.7 | 12 | LT 572 | 8-38 |
| Engine damper | Bolt | M6 | 2 | 6.6 | 0.66 | 4.8 | LT 271 | 8-38 |

| Part to tightened | | Part name | Thread size | Q'ty | Tightening torque | | | Remarks | Refer to page |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | N•m | kgf•m | ft•lb | | |
| **Electrical** | | | | | | | | | |
| Fuse box | | Nut | — | 2 | 17 | 1.7 | 12 | | 7-2 |
| Fuse box bracket | | Nut | — | 4 | 15 | 1.5 | 11 | | 7-2 |
| ECM | | Bolt | M6 | 4 | 4.0 | 0.4 | 2.9 | LT 572 | 7-7 |
| Bracket | 1st | Bolt | M8 | 2 | 8.8 | 0.88 | 6.4 | LT 572 | 7-7 |
| | 2nd | | | | 18 | 1.8 | 13 | | |
| Slant detection switch | | Tapping screw | ø6 | 2 | 3.9 | 0.39 | 2.8 | | 7-2 |
| Rectifier/regulator | | Bolt | M8 | 2 | 4.0 | 0.4 | 2.9 | LT 572 | 7-7 |
| Brush assembly/spacer | | Nut | — | 1 | 8.8 | 0.88 | 6.4 | | 7-39 |
| Starter motor rear cover | | Bolt | M5 | 2 | 6.4 | 0.64 | 4.6 | | 7-39 |
| Remote control transmitter cover | | Tapping screw | ø2 | 6 | 0.1 | 0.01 | 0.1 | | 7-64 |

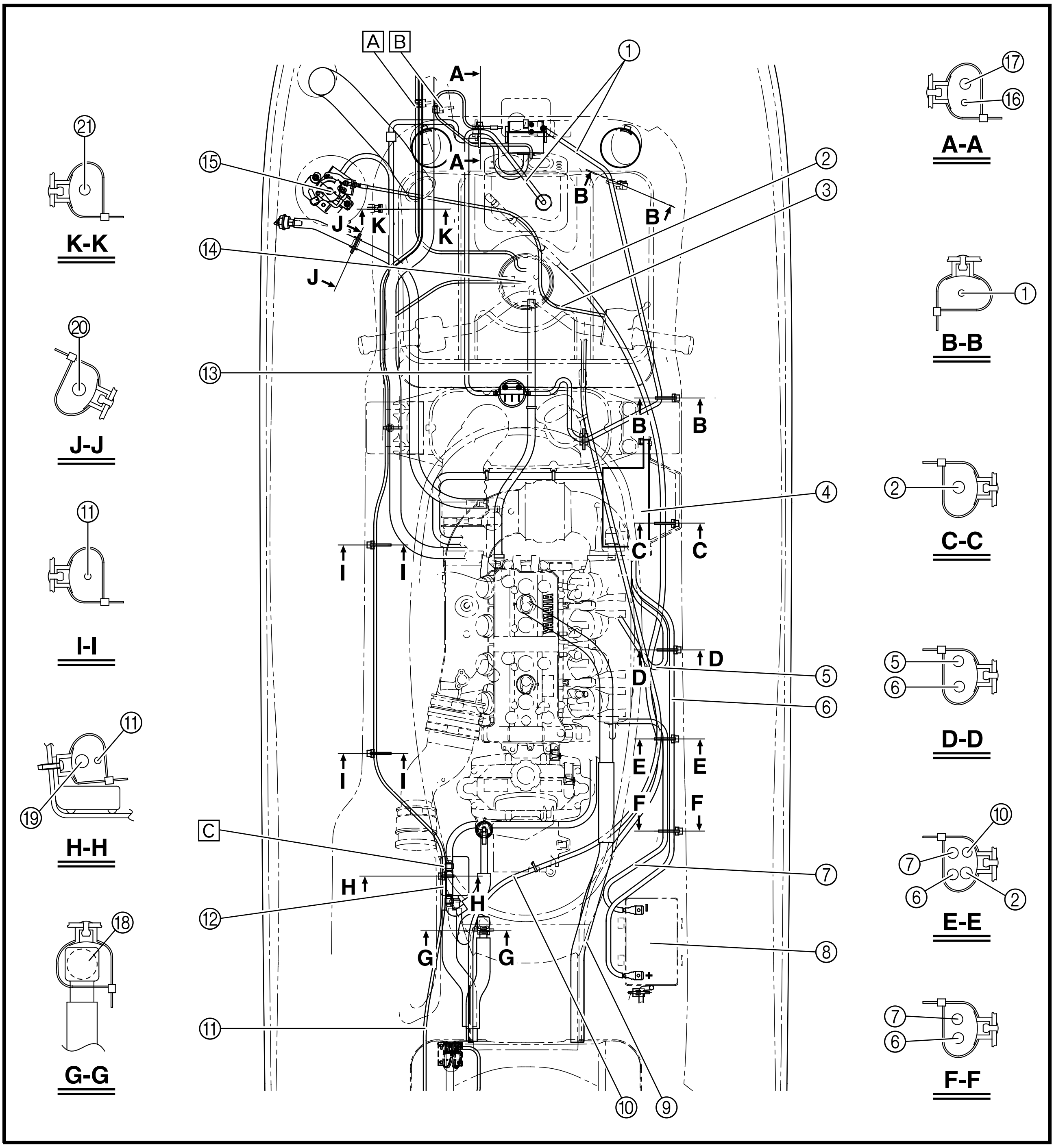
## GENERAL TORQUE

This chart specifies tightening torques for standard fasteners with a standard ISO thread pitch. Tightening torque specifications for special components or assemblies are provided in applicable sections of this manual. To avoid warpage, tighten multi-fastener assemblies in a crisscross fashion and progressive stages until the specified tightening torque is reached. Unless otherwise specified, tightening torque specifications require clean, dry threads. Components should be at room temperature.

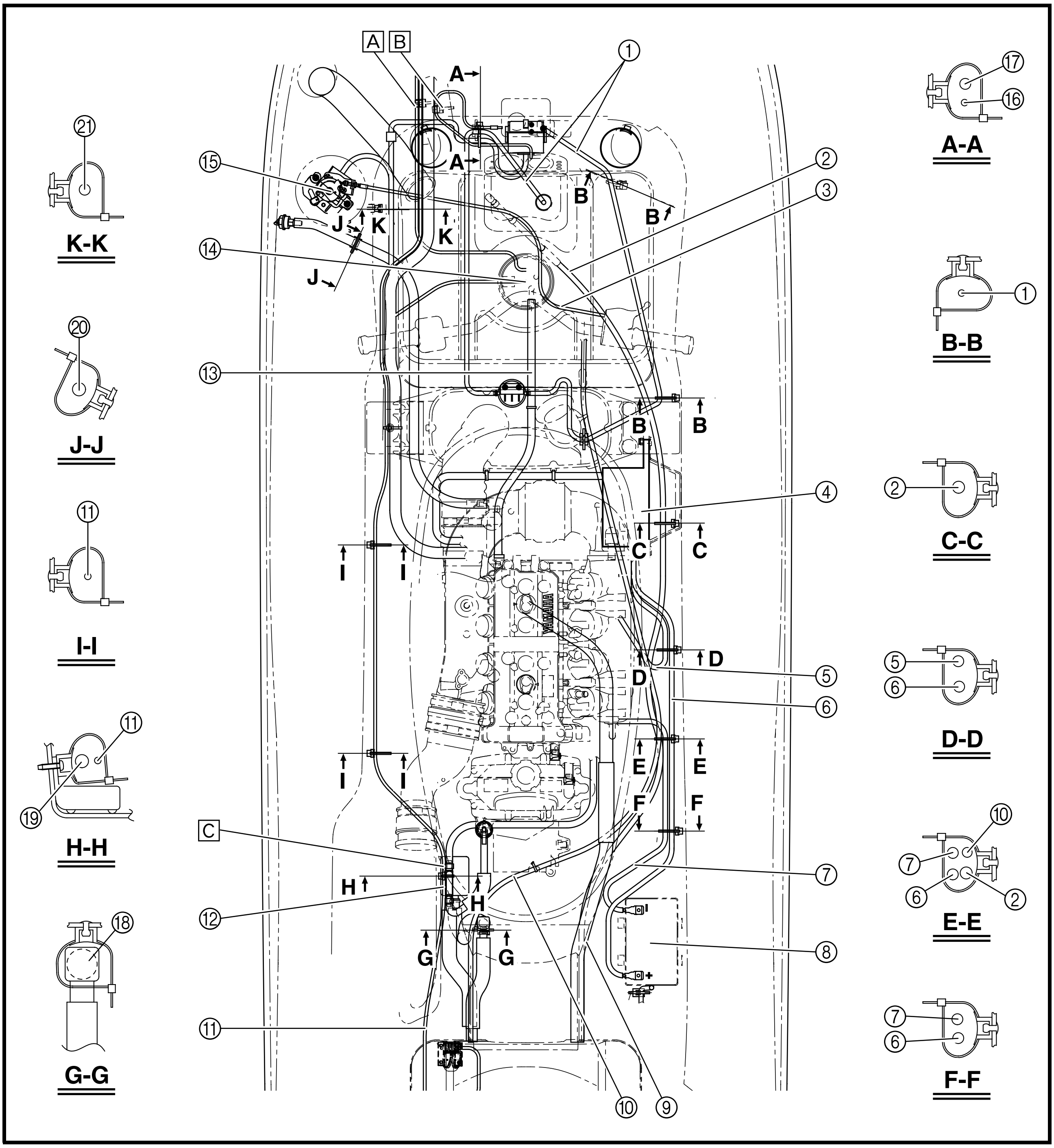
| Nut Ⓐ | Bolt Ⓑ | General torque specifications | | |
|---|---|---|---|---|
| | | N•m | kgf•m | ft•lb |
| 8 mm | M5 | 5.0 | 0.5 | 3.6 |
| 10 mm | M6 | 8.0 | 0.8 | 5.8 |
| 12 mm | M8 | 18 | 1.8 | 13 |
| 14 mm | M10 | 36 | 3.6 | 26 |
| 17 mm | M12 | 43 | 4.3 | 31 |



# CABLE AND HOSE ROUTING



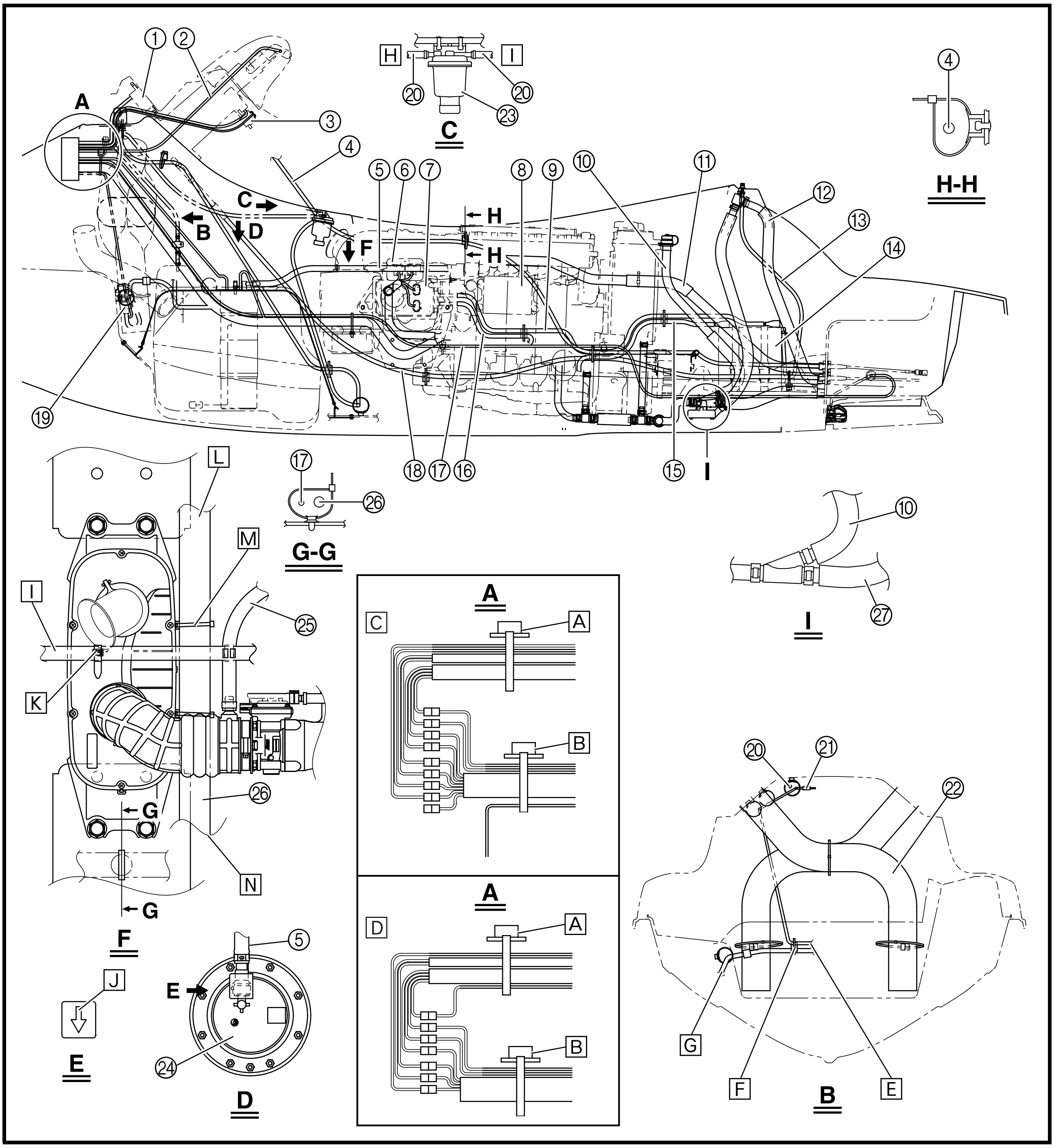

1. Fuel tank breather hose
2. Steering cable
3. Throttle cable
4. Fuse box
5. Starter motor lead
6. Positive battery lead
7. Negative battery lead
8. Battery
9. Cooling water outlet hose
10. Shift cable (Deluxe model only)
11. Speed sensor lead
12. Cooling water inlet hose
13. Fuel hose
14. Electric fuel pump
15. Accelerator position sensor
16. Antenna lead (Deluxe model only)
17. Remote control unit lead (Deluxe model only)
18. Bilge hose joint
19. Cooling water hose joint
20. Cooling water pilot outlet hose
21. Accelerator position sensor lead



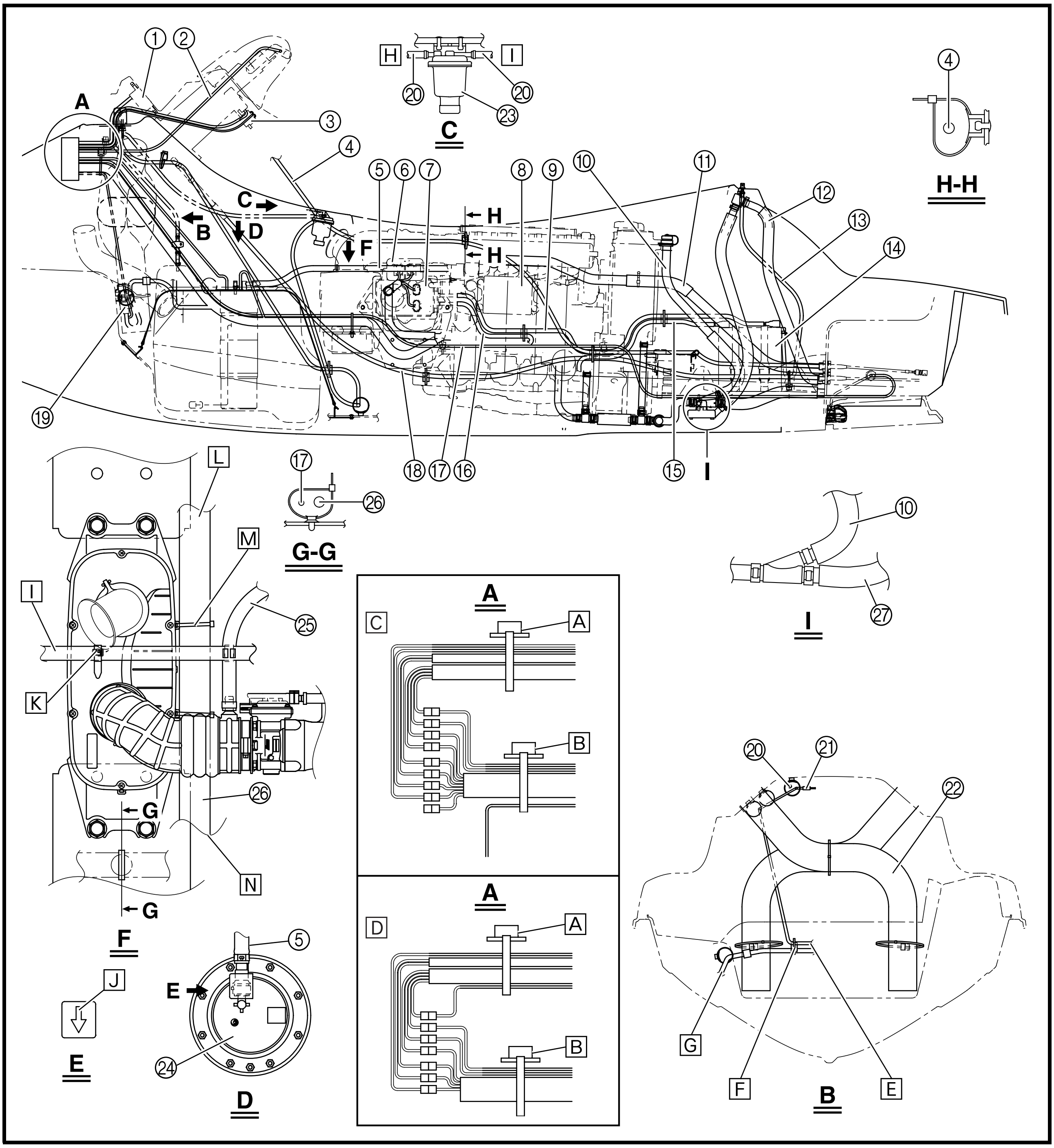

A Fasten the speed sensor lead, fuel sender lead, wiring harness, and antenna lead (Deluxe model only) with plastic tie 1 at the white tape on the wiring harness.

B Fasten the steering sensor lead, handlebar switch lead, multifunction meter lead, and buzzer lead with plastic tie 2.

C To install the cooling water inlet hose, align the white paint mark on the hose with the parting line on the hose joint.



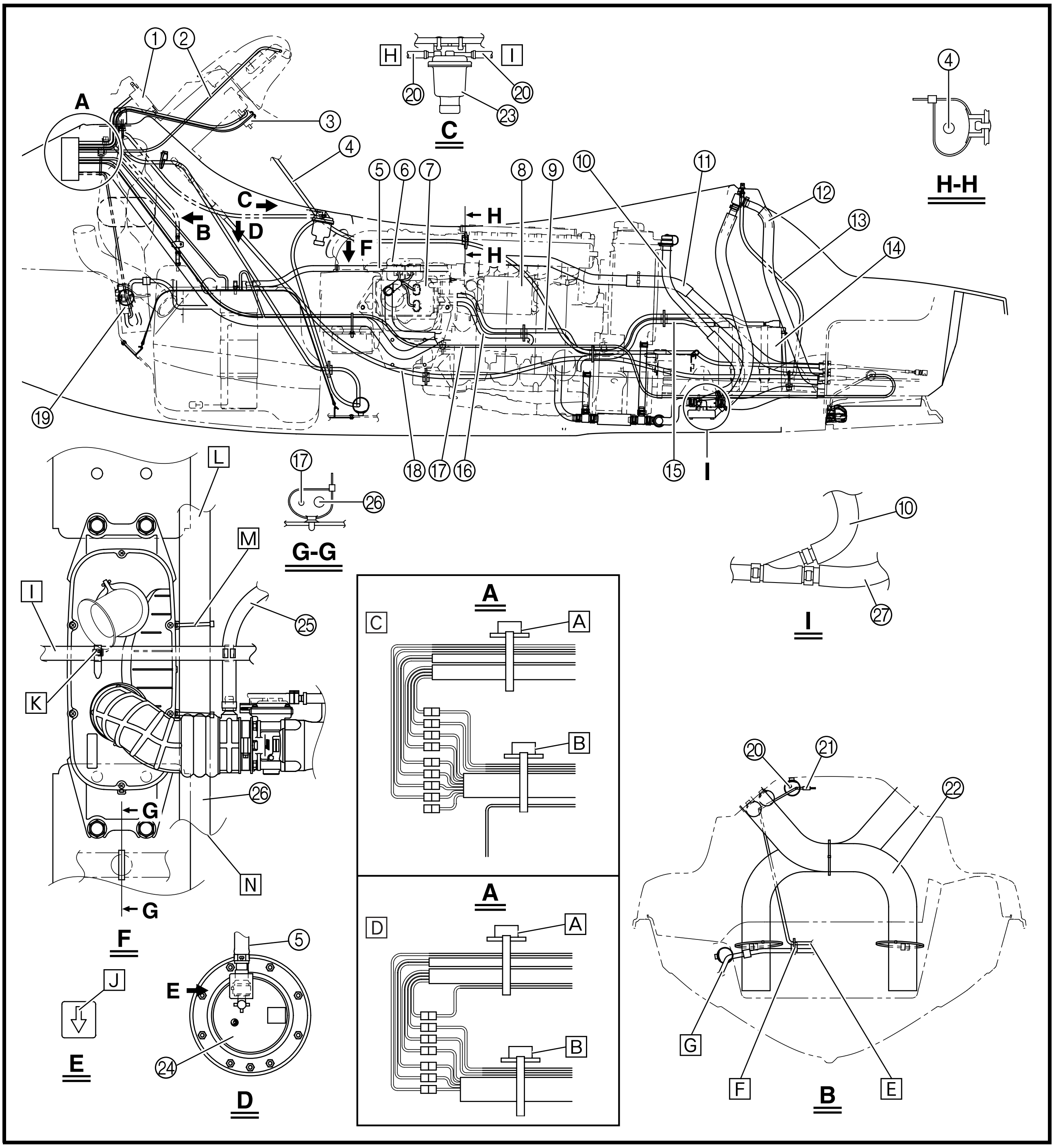
① Multifunction meter
② Handlebar switch lead
③ Buzzer
④ Shift cable (Deluxe model only)
⑤ Fuel hose
⑥ Relay assembly
⑦ Fuse box
⑧ ECM
⑨ Positive battery lead
⑩ Flushing hose
⑪ Cooling water outlet hose
⑫ Bilge hose
⑬ Battery breather hose
⑭ Battery
⑮ Negative battery lead
⑯ Starter motor lead
⑰ Speed sensor lead
⑱ Steering cable
⑲ Remote control unit lead (Deluxe model only)
⑳ Fuel tank breather hose
㉑ Antenna lead (Deluxe model only)
㉒ Ventilation hose



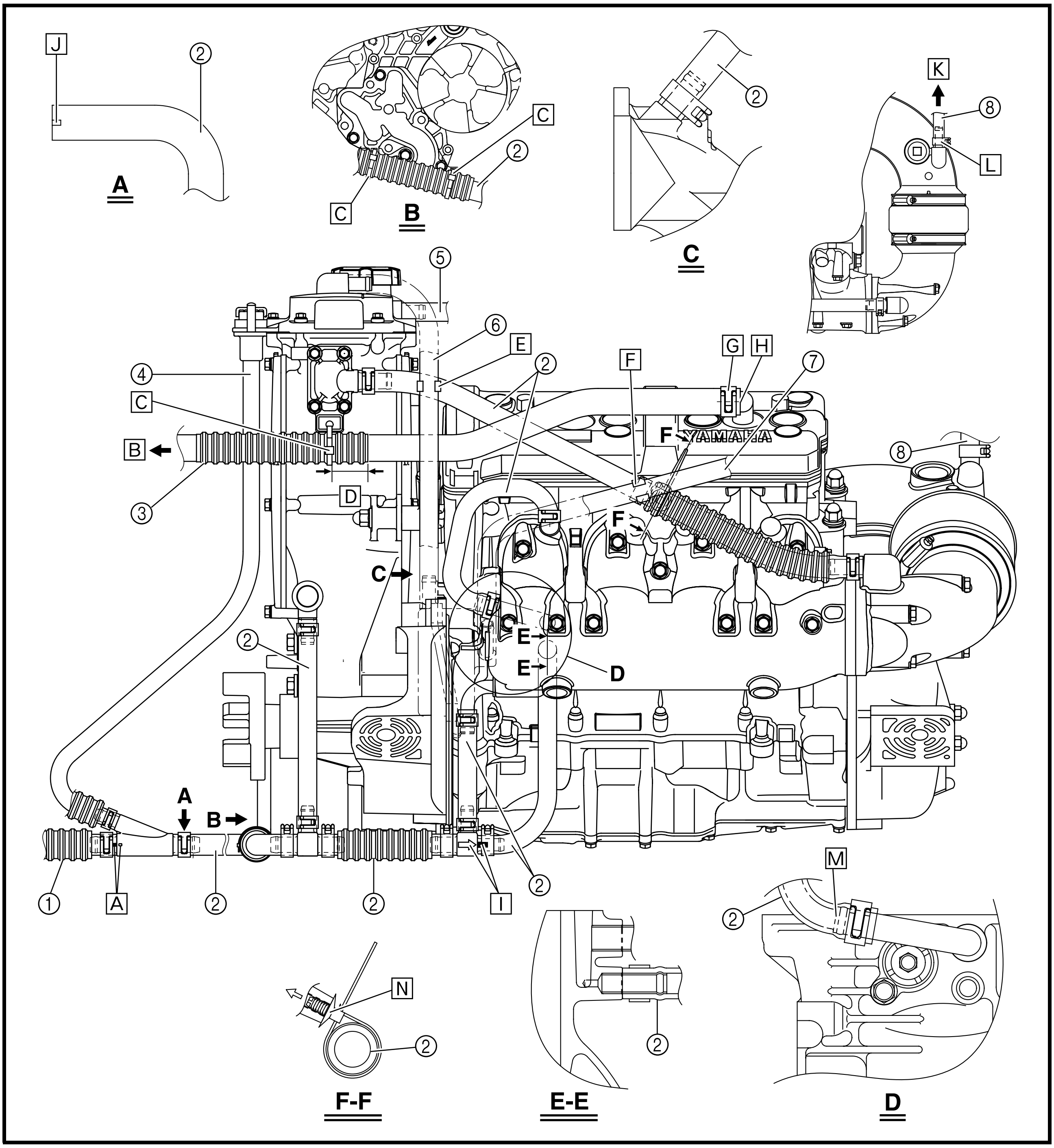

23 Water separator
24 Electric fuel pump
25 Oil separator breather hose (to air intake duct)
26 Wiring harness
27 Cooling water inlet hose

A Fasten the steering sensor lead, handlebar switch lead, multifunction meter lead, and buzzer lead with plastic tie 2.

B Fasten the speed sensor lead, fuel sender lead, wiring harness, and antenna lead (Deluxe model only) with plastic tie 1 at the white tape on the wiring harness.
C Deluxe model
D Sport model
E To remote control unit (Deluxe model only)
F Fasten the antenna lead and wiring harness with a plastic tie at the white tape. (Deluxe model only)
G To engine unit (Deluxe model only)

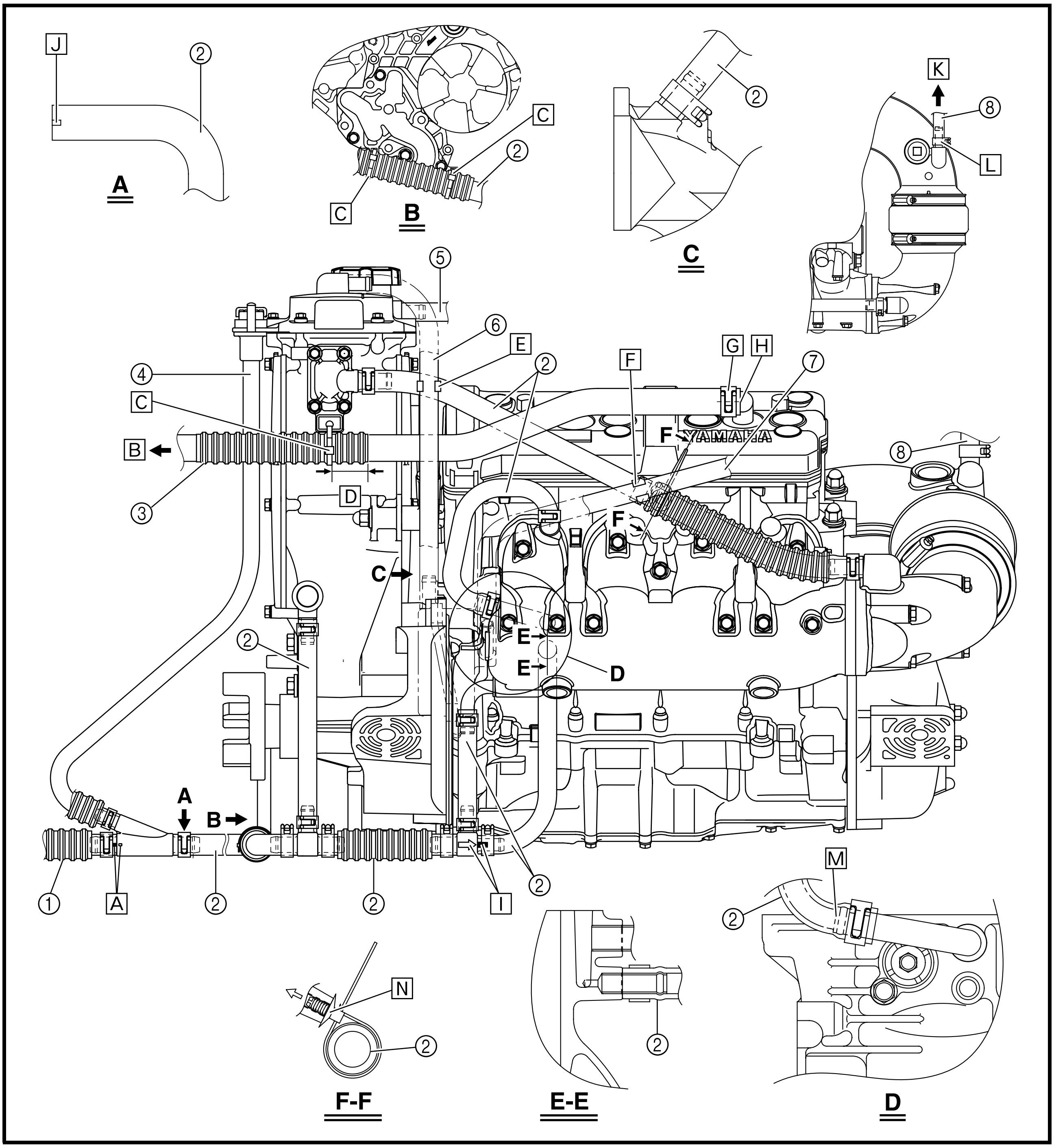



H To ventilation socket
I To fuel tank
J Point the arrow on the cover toward the fuel tank.
K Fasten the fuel hose with a plastic tie.
L To fuse box
M Fasten the wiring harness with a plastic tie at the white tape.
N To ECM

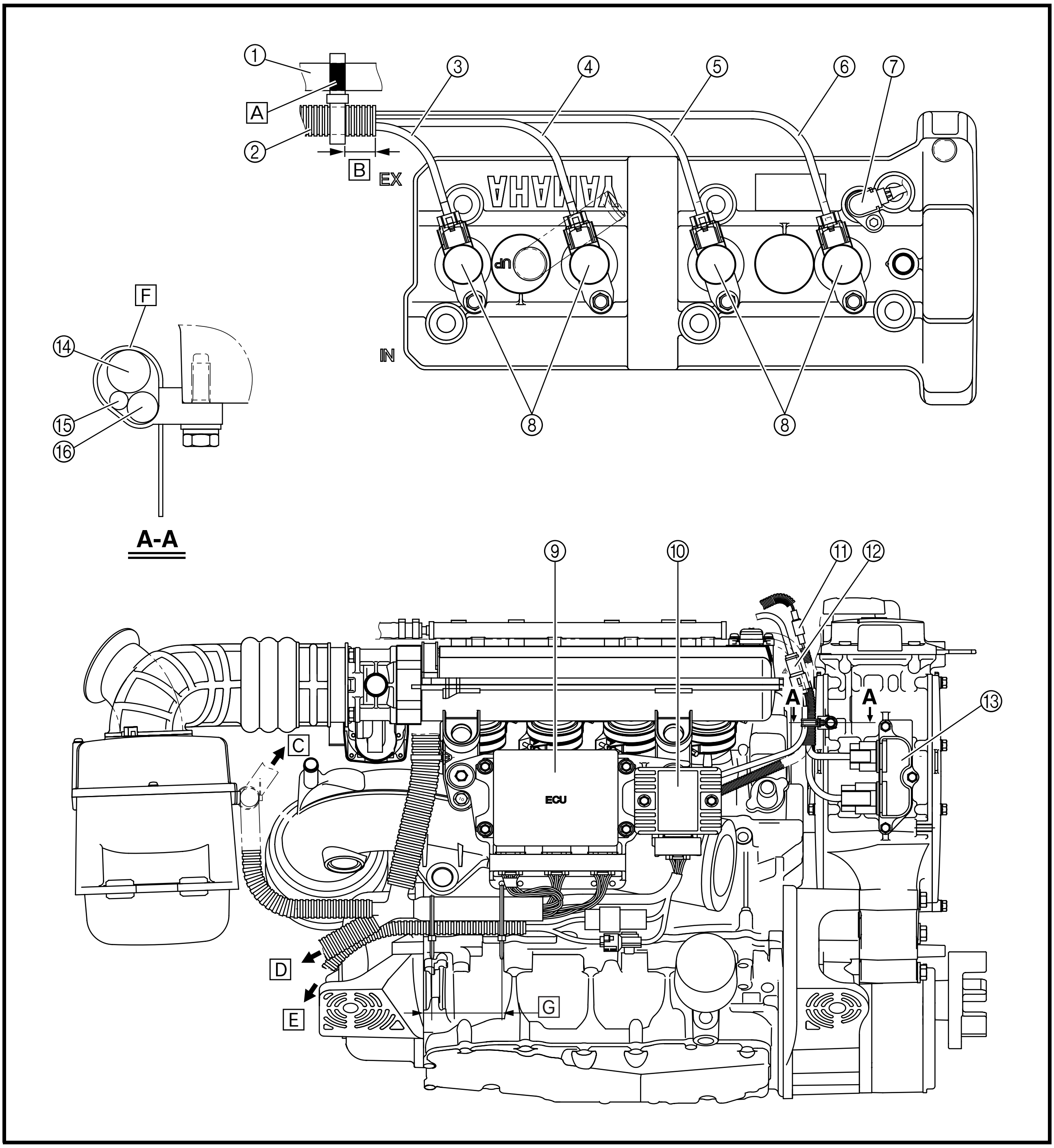


① Cooling water inlet hose
② Cooling water hose
③ Cooling water outlet hose
④ Flushing hose
⑤ Cylinder head breather hose
⑥ Oil separator breather hose (to oil tank)
⑦ Oil separator breather hose (to air intake duct)
⑧ Cooling water pilot outlet hose

A To install the cooling water outlet hose, align the white paint mark on the cooling water hose with the projection of the hose joint.
B To transom plate
C Fasten the cooling water outlet hose with a plastic tie.
D 25–45 mm (0.98–1.77 in)
E Fasten the oil separator breather (to oil tank) hose and cooling water hose with a holder.

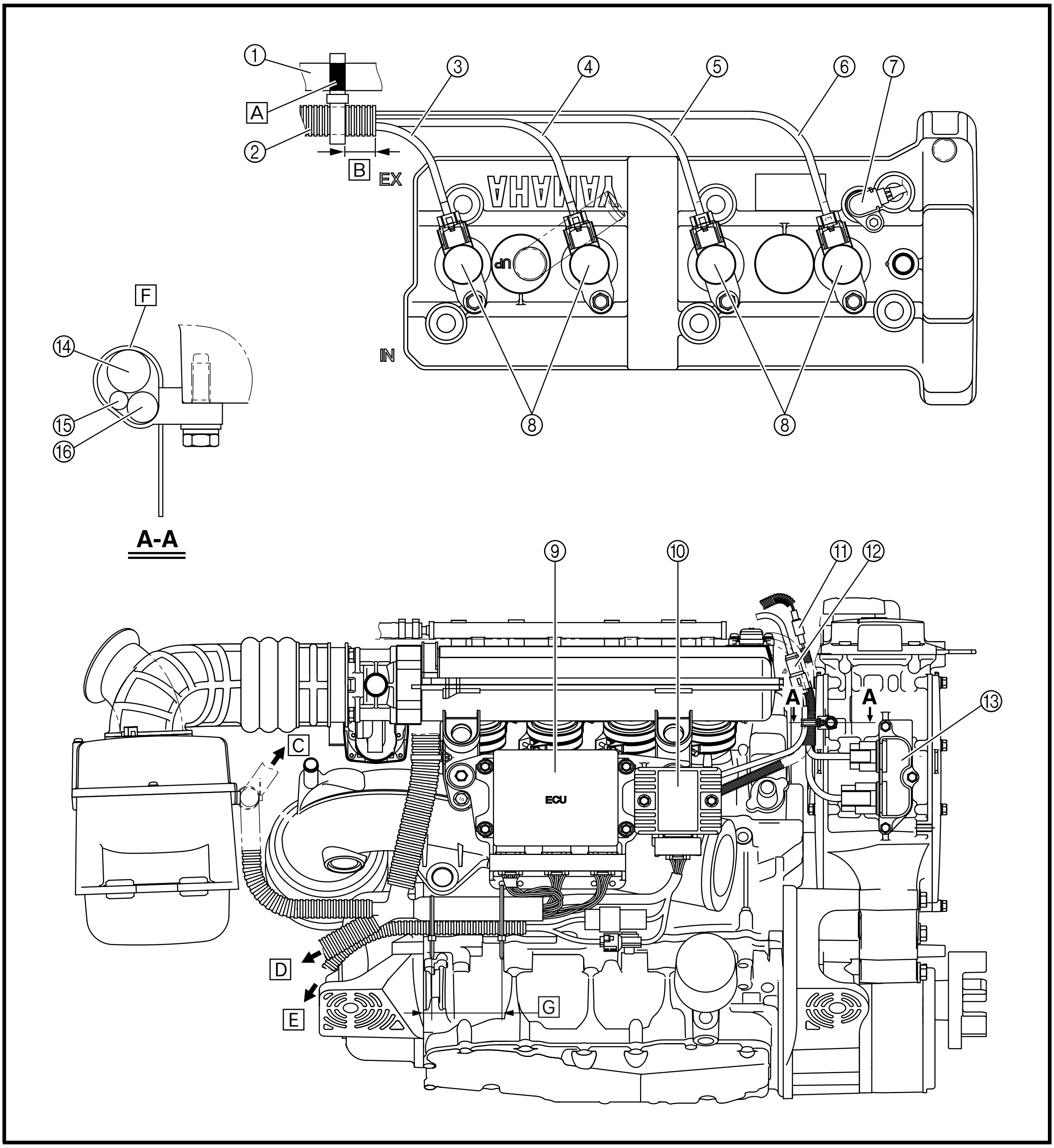



F Fasten the oil separator breather hose (to air intake duct) and cooling water hose with a holder.
G Face the ends of the hose clamp towards the starboard (right) side of the watercraft.
H Insert the cooling water hose to the paint mark.
I To install the cooling water hose, align the white paint mark on the cooling water hose with the arrow mark of the hose joint.
J Install the cooling water hose with the white paint mark facing up.
K To cooling water pilot outlet
L Face the ends of the hose clamp towards the bow.
M Install the hose onto the cooling water pipe until the pipe reaches the curve in the hose.
N Insert the plastic tie completely into the hole in the boss on the cylinder block.

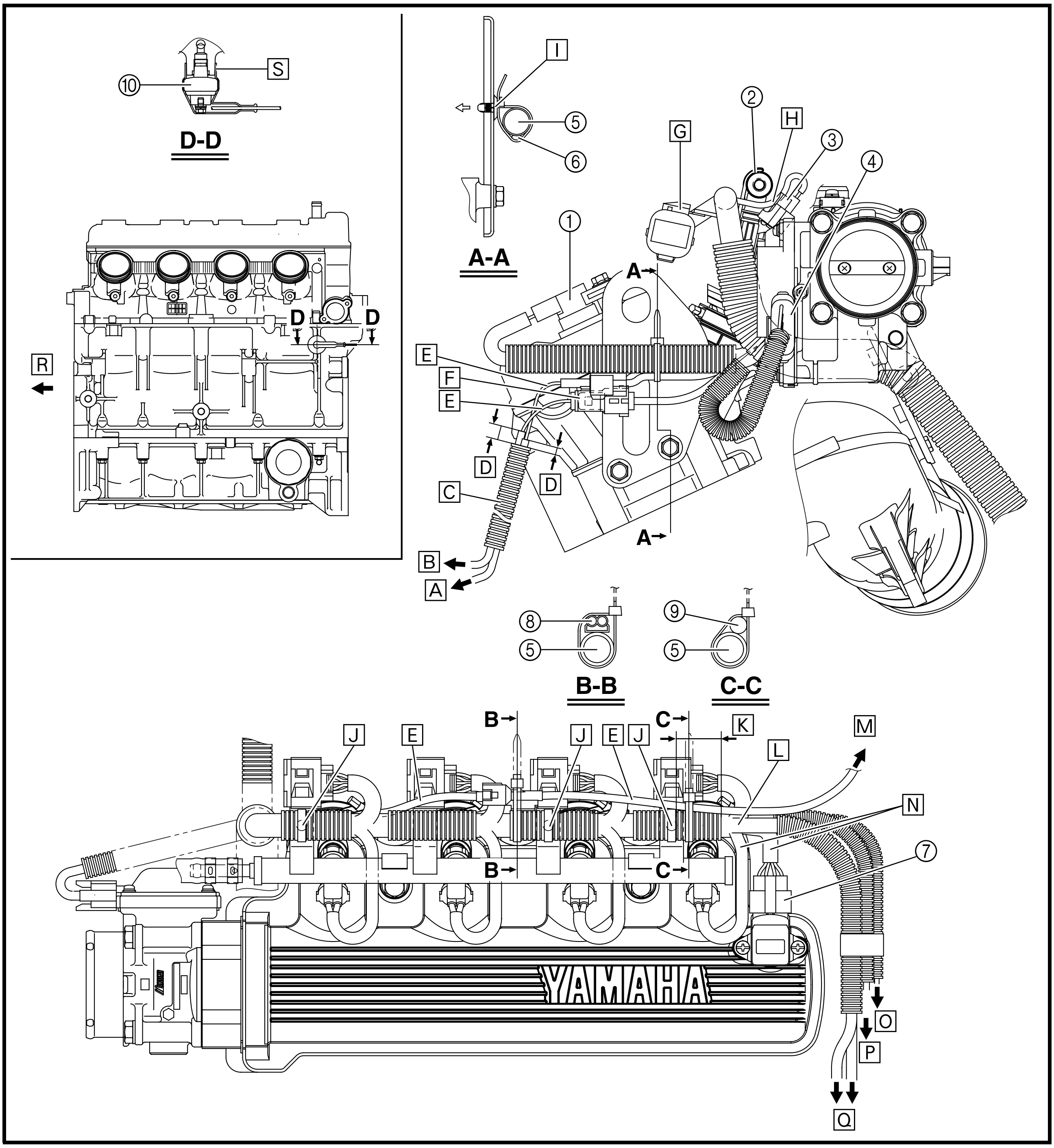



① Oil separator breather hose (to air intake duct)
② Wiring harness
③ Ignition coil lead #1
④ Ignition coil lead #2
⑤ Ignition coil lead #3
⑥ Ignition coil lead #4
⑦ Cam position sensor
⑧ Ignition coil
⑨ ECM
⑩ Rectifier/regulator
⑪ Oil pressure switch coupler
⑫ Thermoswitch (exhaust) coupler
⑬ Ground lead plate
⑭ Wiring harness
⑮ Thermoswitch (exhaust) lead
⑯ Oil pressure switch lead

A Fasten the oil separator breather hose (to air intake duct) at the paint mark with a holder.
B 15–25 mm (0.59–0.98 in)
C To fuse box
D To multifunction meter

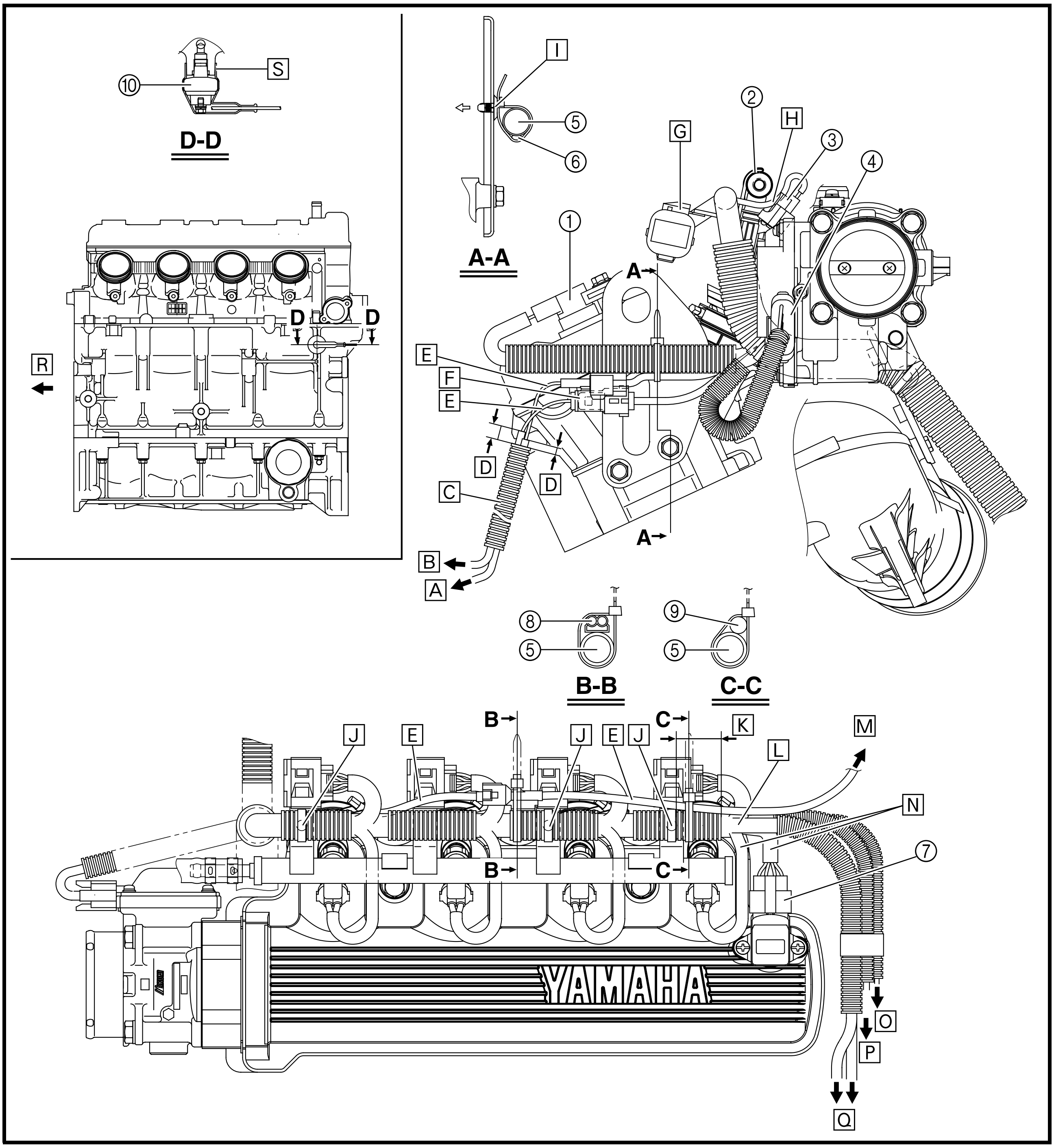



E To generator
F Fasten the thermoswitch (exhaust) lead at the protective sleeve, the oil pressure switch lead at the corrugated tube, and the wiring harness at the tape on the harness with a plastic tie.
G 60–80 mm (2.36–3.15 in)




① Ignition coil
② Fuel rail
③ Fuel injector coupler
④ Throttle body assembly coupler
⑤ Wiring harness
⑥ Engine temperature sensor lead
⑦ Sensor assembly (intake air pressure and intake air temperature)
⑧ Cam position sensor coupler
⑨ Cam position sensor lead
⑩ Oil pressure switch

A To engine temperature sensor
B To thermoswitch (engine)
C Route the engine thermoswitch lead and engine temperature sensor lead through the corrugated tube.
D More than 10 mm (0.39 in)
E Do not leave any slack in the lead.
F Attach the thermoswitch (engine) coupler to the bracket.
G Attach a joint connector to the bracket.
H Pass the fuel injector leads under the fuel rail.




I Insert the plastic tie completely into the hole in the engine hanger.
J Fasten the wiring harness to a bracket on the fuel rail with a plastic tie.
K Fasten the wiring harness and cam position sensor within the range shown in the illustration with a plastic tie.
L Split in wiring harness
M To cam position sensor
N Pass fuel injector lead #4 under the sensor assembly (intake air pressure and intake air temperature) lead.
O To oil pressure switch
P To thermoswitch (exhaust)
Q To ground lead plate
R Bow end
S Make sure that the rubber boot is fitted properly without any folds.

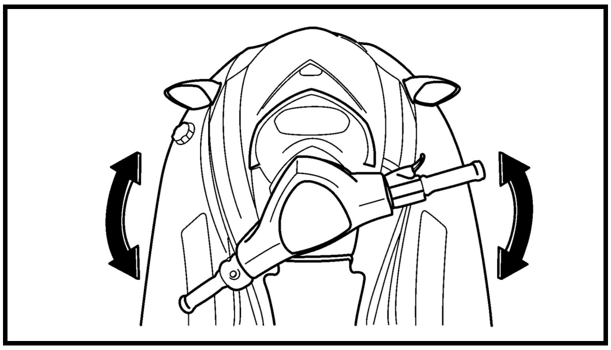
# CHAPTER 3
# PERIODIC INSPECTION AND ADJUSTMENT

## MAINTENANCE INTERVAL CHART

The following chart should be considered strictly as a guide to general maintenance intervals. Depending on operating conditions, the intervals of maintenance should be changed.

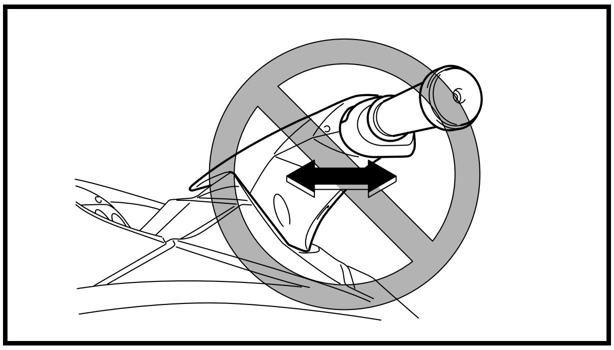
| MAINTENANCE INTERVAL / ITEM | | INITIAL | | | THEREAFTER EVERY | | PAGE |
|---|---|---|---|---|---|---|---|
| | | 10 hours | 50 hours | 100 hours | 100 hours | 200 hours | |
| | | | 6 months | 12 months | 12 months | 24 months | |
| Spark plug | Inspect, clean, adjust | ○ | | ○ | ○ | | 3-20 |
| Lubrication points | Lubricate | | | ○ | ○ | | 3-26 |
| Fuel system | Inspect | | | ○ | ○ | | 3-7 |
| Fuel tank | Inspect, clean | | | ○ | ○ | | 3-7 |
| Trolling speed | Inspect | | | ○ | ○ | | 3-6 |
| Throttle shaft | Inspect | | | ○ | ○ | | — |
| Cooling water passages | Flush | ○*1 | | | | | — |
| Water inlet strainer | Inspect, clean | | | ○ | ○ | | — |
| Bilge strainer | Clean | | | ○ | ○ | | 3-26 |
| Impeller | Inspect | | | ○ | ○ | | 3-25 |
| Jet thrust nozzle angle | Inspect, adjust | | | ○ | ○ | | 3-2 |
| Shift cable and mechanism (Deluxe model only) | Inspect, adjust | | | ○ | ○ | | 3-5 |
| Throttle cable | Inspect, adjust | ○ | | ○ | ○ | | 3-4 |
| Stern drain plugs | Inspect, replace | | | ○ | ○ | | 3-26 |
| Battery | Inspect | | | ○ | ○ | | 3-22 |
| Rubber coupling | Inspect | | | | | ○ | — |
| Engine mount | Inspect | | | | | ○ | 5-7 |
| Nuts and bolts | Inspect | ○ | | ○ | ○ | | — |
| Air filter | Inspect, replace | | | ○ | ○ | | 3-18 |
| Engine oil | Replace | ○ | | ○ | ○ | | 3-14 |
| Engine oil filter | Replace | | | ○ | ○ | | 3-16 |
| Valve clearance | Inspect, adjust | | | | | ○ | 3-8 |

*1: After every use

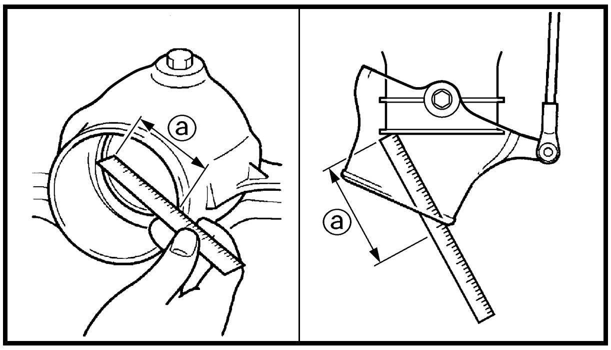


# PERIODIC SERVICE
## CONTROL SYSTEM
### Steering column inspection

1. Inspect:
   - Steering column
     Excessive play → Replace the steering column.
     Refer to "STEERING COLUMN" in Chapter 8.



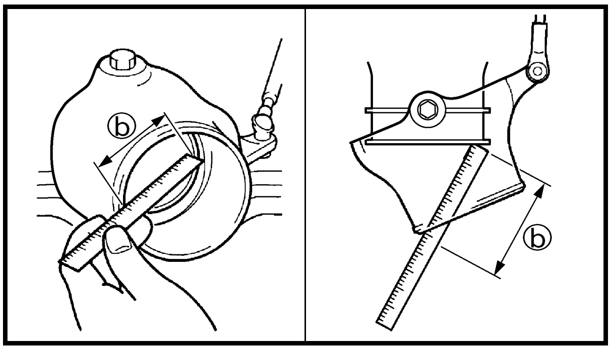
**Inspection steps:**
- Move the handlebar up and down and back and forth.
- Check the excessive play of the handlebar.



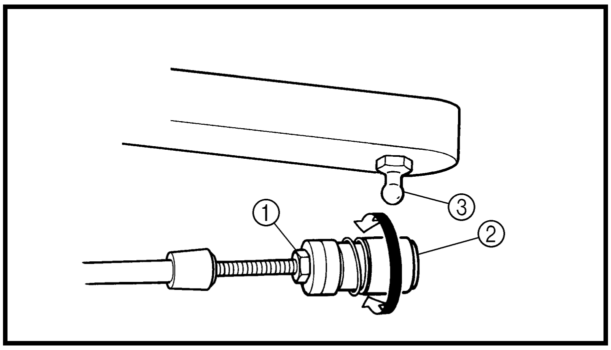

### Steering cable inspection and adjustment

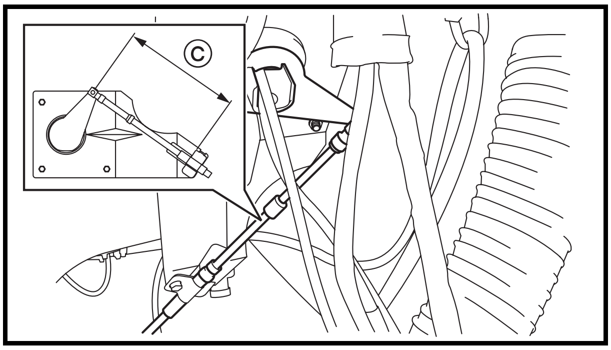
1. Inspect:
   - Jet thrust nozzle distances ⓐ and ⓑ
     Out of specification → Adjust.

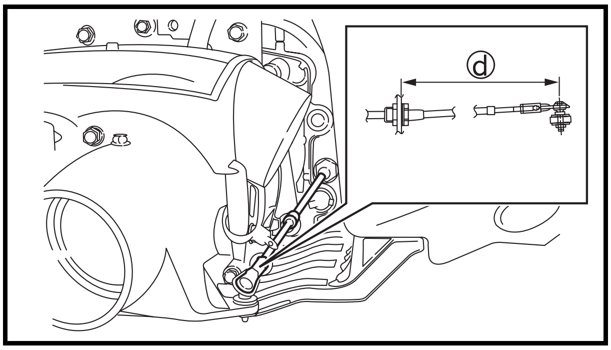
**Difference of distances ⓐ and ⓑ:**
**Maximum 5 mm (0.2 in)**

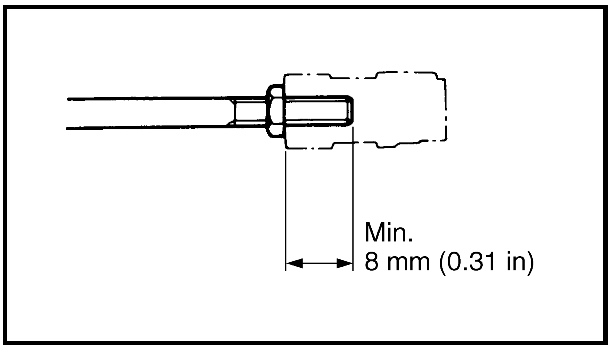



**Measurement steps:**
- Set the control grip to the neutral position.
- Turn the handlebar lock to lock.
- Measure distances ⓐ and ⓑ.
- If the difference of distances ⓐ and ⓑ is not within specification, adjust the cable joint.




2. Adjust:
   - Steering cable joint
     (steering column end)

**Adjustment steps:**

- Set the control grip to the neutral position.
- Loosen the locknut ①.
- Disconnect the cable joint ② from the ball joint ③.
- Turn the cable joint ② in or out to adjust the steering cable length ⓒ.

**Steering cable length ⓒ:**
**218.8 mm (8.61 in)**

**NOTE:**

- Check that the sum of lengths ⓒ and ⓓ is 581.8 ± 1 mm (22.91 ± 0.04 in).
- If the sum of lengths ⓒ and ⓓ is out of specification, adjust length ⓓ, and then check the jet thrust nozzle distances again.

**⚠ WARNING**

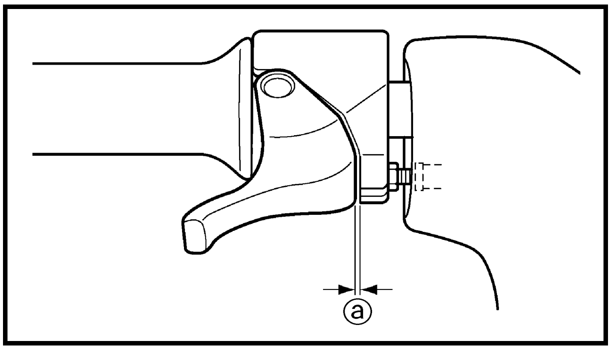
**The cable joint must be screwed in more than 8 mm (0.31 in).**

- Connect the cable joint and tighten the locknut.

**Locknut:**
**6.8 N • m (0.68 kgf • m, 4.9 ft • lb)**

**NOTE:**

Adjust the cable joint at the jet pump end. Refer to “REMOTE CONTROL CABLES AND SPEED SENSOR LEAD” in Chapter 8.

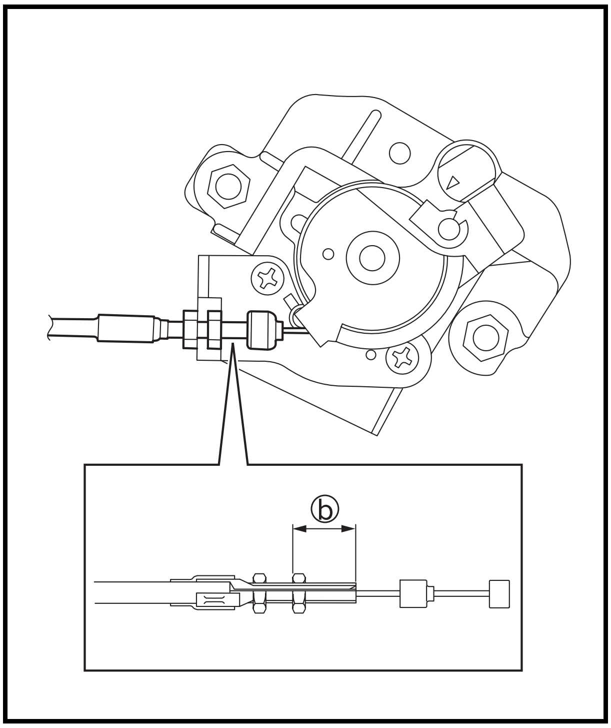



### Throttle cable inspection and adjustment

**NOTE:**
Before adjusting the throttle lever free play, check the trolling speed.

1. Measure:
   - Throttle lever free play ⓐ
     Out of specification → Adjust.

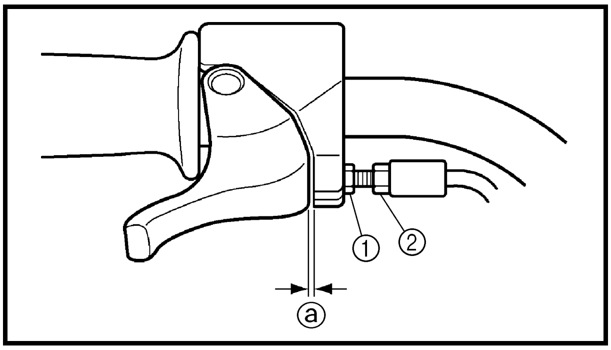
| | **Throttle lever free play ⓐ:** **4–7 mm (0.16–0.28 in)** |
|---|---|




   - Throttle cable length ⓑ
     Out of specification → Adjust.

| | **Throttle cable length ⓑ:** **18.4 ± 1 mm (0.72 ± 0.04 in)** |
|---|---|

**NOTE:**
- Check that the throttle cable length ⓑ is 18.4 ± 1 mm (0.72 ± 0.04 in). Adjust if necessary.
- Adjust the throttle lever free play at the throttle lever end of the throttle cable.




2. Adjust:
   - Throttle lever free play ⓐ

**Adjustment steps:**
a. Remove the handlebar cover.
b. Loosen the locknut ①.
c. Turn the adjuster ② in or out until the specified free play is obtained.

| | |
|---|---|
| **Turn in** | **Free play is increased.** |
| **Turn out** | **Free play is decreased.** |

d. Tighten the locknut ①.

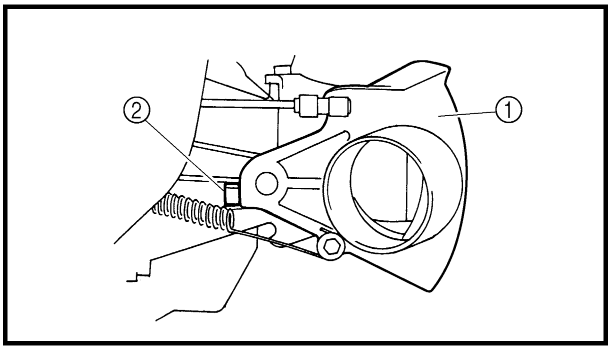
**NOTE:**
If the throttle cable free play cannot be adjusted properly, replace the throttle cable.

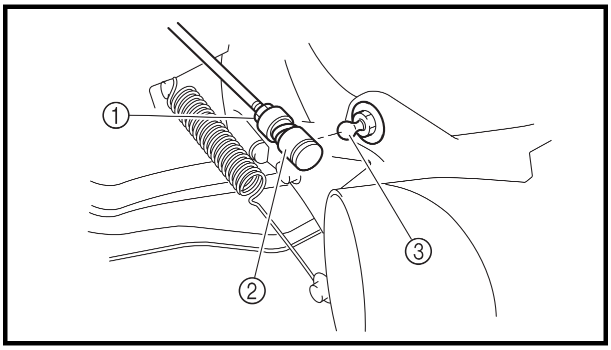
e. Install the handlebar cover.

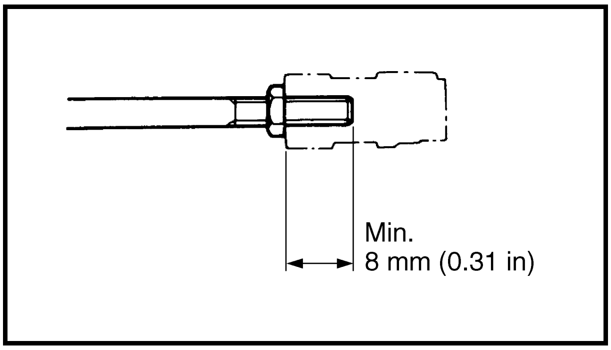
**Lower handlebar cover screw:**
**3.7 N • m (0.37 kgf • m, 2.7 ft • lb)**
**LOCTITE 242**
**Upper handlebar cover screw:**
**1.1 N • m (0.11 kgf • m, 0.8 ft • lb)**

**⚠ WARNING**

**After adjusting the free play, turn the handlebar to the right and left and make sure that the trolling speed does not increase.**




**Shift cable inspection and adjustment (Deluxe model only)**

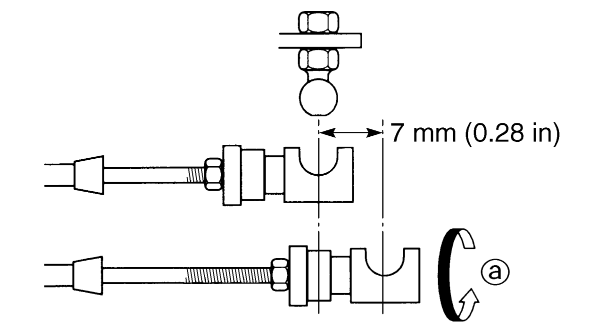
1. Check:
   - Reverse gate stopper lever position
     Incorrect → Adjust.

**Checking steps:**
- Set the shift lever to the reverse position.
- Check that the reverse gate ① contacts the stopper ②.

2. Adjust:
   - Shift cable joint

**Adjustment steps:**
- Loosen the locknut ①.
- Disconnect the cable joint ② from the ball joint ③.
- Situate the reverse gate to the stopper.
- Turn the cable joint in or out to align it with the ball joint.

| Turn in | Length is decreased. |
|---|---|
| Turn out | Length is increased. |




- Turn out the cable joint nine times ⓐ to extend the cable 7 mm (0.28 in) from the aligned position.

**⚠ WARNING**

**The cable joint must be screwed in more than 8 mm (0.31 in).**

- Connect the cable joint and tighten the locknut.

**Locknut:**
**3.8 N • m (0.38 kgf • m, 2.7 ft • lb)**

**Trolling speed inspection**

1. Inspect:
   - Trolling speed

**Trolling speed:**
**1,550–1,750 r/min**

**Checking steps (watercraft in water):**
- Start the engine and allow it to warm up for 15 minutes.
- Check the engine trolling speed using the tachometer of the multifunction meter or using the Yamaha Diagnostic System.

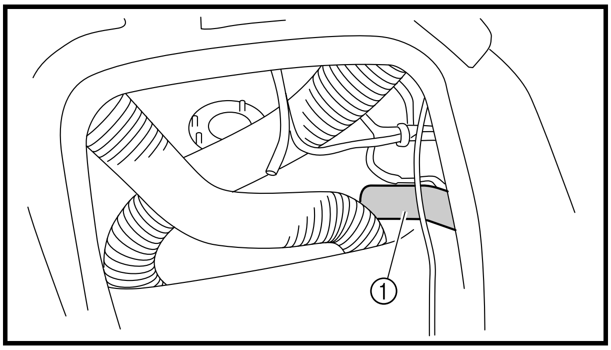
## FUEL SYSTEM

**⚠ WARNING**

**When removing fuel system parts, wrap them in a cloth and take care that no fuel spills into the engine compartment.**

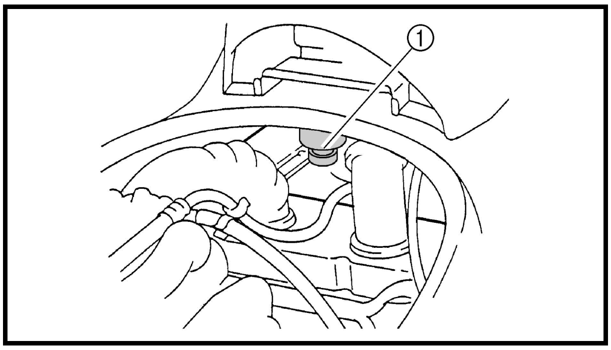
### Fuel line inspection

1. Inspect:
   - Fuel pump filter
     Clog/contaminants → Clean.
     Refer to "FUEL TANK AND FUEL PUMP MODULE" in Chapter 4.
   - Fuel hose
     Cracks/damage → Replace.
   - O-rings (quick connector)
     Cracks/damage → Replace the quick connector.
   - Fuel rail
     Cracks/damage → Replace.
     Refer to "FUEL INJECTION SYSTEM" in Chapter 4.
   - Fuel filler hose
   - Fuel filler cap
     Cracks/damage → Replace.




2. Inspect:
   - Fuel tank
     Cracks/damage → Replace.
     Water accumulation → Remove.

**NOTE:**
- To remove water from the fuel tank, remove the fuel filler hose ① and use a siphon pump.
- Refer to "FUEL TANK AND FUEL PUMP MODULE" in Chapter 4.




**Water separator inspection**

1. Inspect:
   - Water separator ①
     Water accumulation → Drain.

**NOTE:**
To drain the water, remove the drain plug.

## POWER UNIT

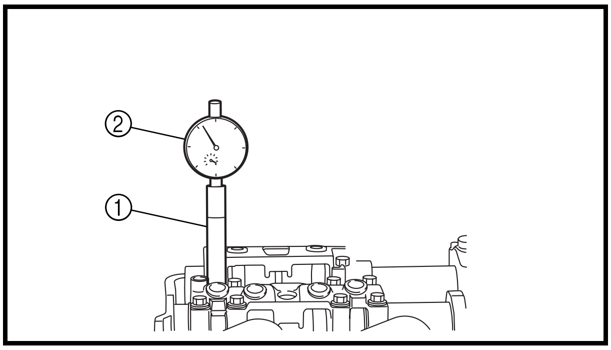
**Valve clearance adjustment**

The following procedure applies to all of the valves.

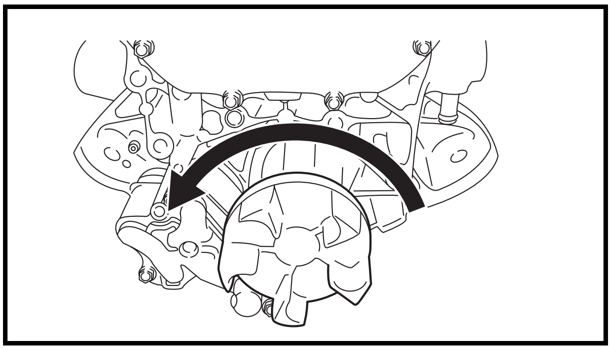
**NOTE:**
- Valve clearance adjustment should be made on a cold engine, at room temperature.
- When the valve clearance is to be measured or adjusted, the piston must be at top dead center (TDC) of the compression stroke.

1. Remove:
   - Ignition coils
   - Spark plugs
   - Cylinder head cover
   - Cylinder head cover gasket
     Refer to “CAMSHAFTS” in Chapter 5.

2. Install:
   - Dial gauge needle
   - Dial gauge stand ①
     (into spark plug hole #1)
   - Dial gauge ②

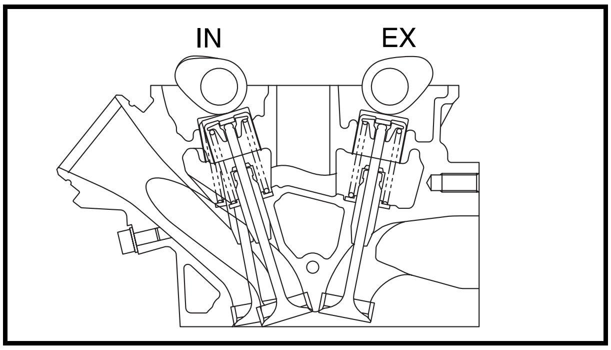



**Dial gauge stand:**
**90890-06583**
**Dial gauge needle:**
**90890-06584**
**Dial gauge stand set:**
**YB-06585/90890-06585**
**Dial indicator gauge:**
**YU-03097**
**Dial gauge set:**
**90890-01252**



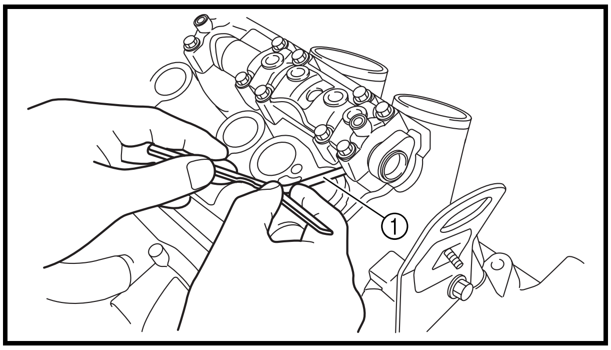
3. Measure:
   - Valve clearance
     Out of specification → Adjust.

**Valve clearance (cold):**
**Intake valve:**
**0.11–0.20 mm**
**(0.0043–0.0079 in)**
**Exhaust valve:**
**0.25–0.34 mm**
**(0.0098–0.0134 in)**



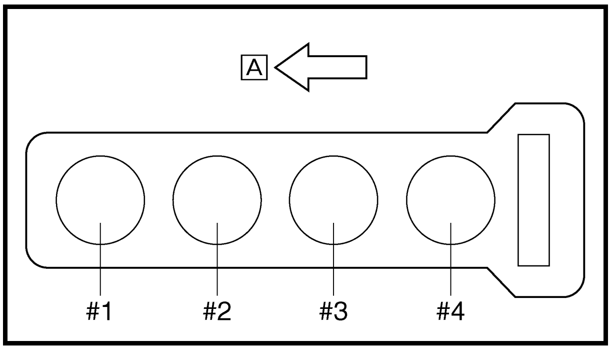

**Measurement steps:**
- Turn the drive coupling counterclockwise, and then check if cylinder #1 is at TDC of the compression stroke with a dial gauge.

**NOTE:**
TDC of the compression stroke can be found when the camshaft lobes are turned away from each other.




- Measure the valve clearance with a thickness gauge ①.

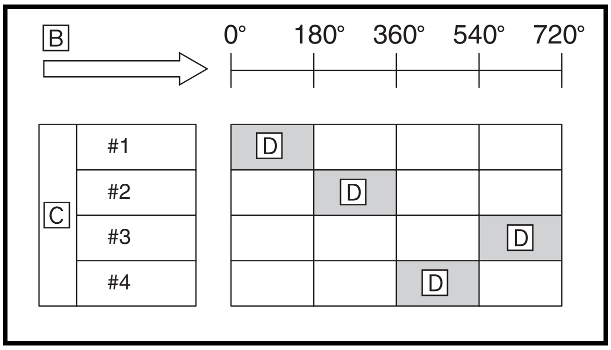
**NOTE:**
- If the valve clearance is incorrect, record the measured reading.
- Measure the valve clearance in the following sequence.



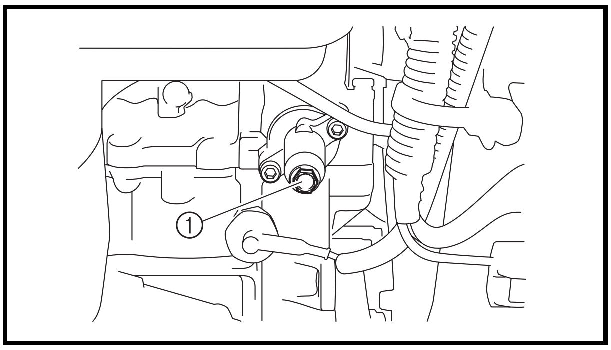

**Valve clearance measuring sequence:**
**Cylinder #1 → #2 → #4 → #3**

A Bow end
- To measure the valve clearances of the other cylinders, starting with cylinder #1 at TDC, turn the drive coupling counterclockwise as specified in the following table.

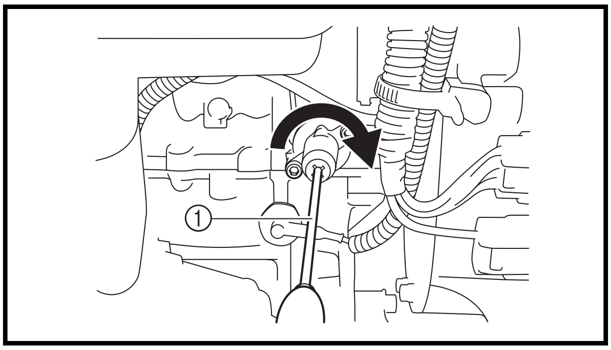
B Degrees that the crankshaft is turned clockwise
C Cylinder
D Combustion cycle




| **Cylinder #2** | **180°** |
|---|---|
| **Cylinder #4** | **360°** |
| **Cylinder #3** | **540°** |




4. Remove:
   - Timing chain tensioner cap bolt ①
   - Gasket

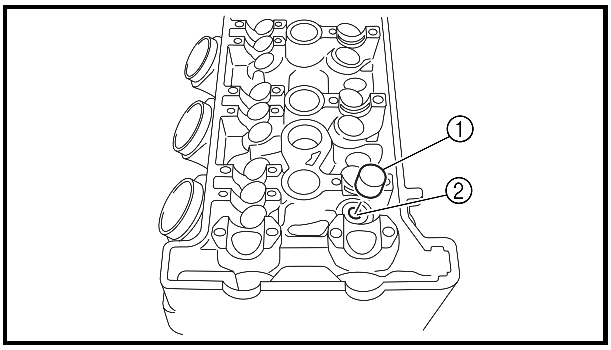


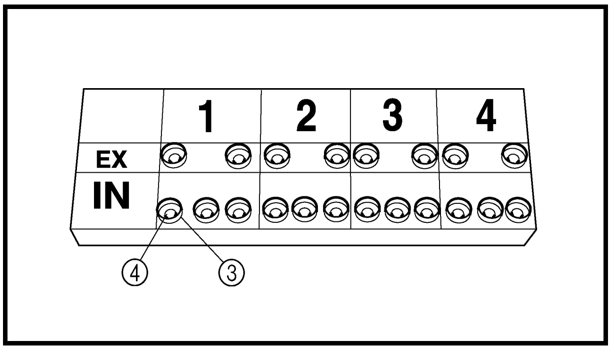

5. Turn the timing chain tensioner rod fully clockwise with a thin screwdriver ①.

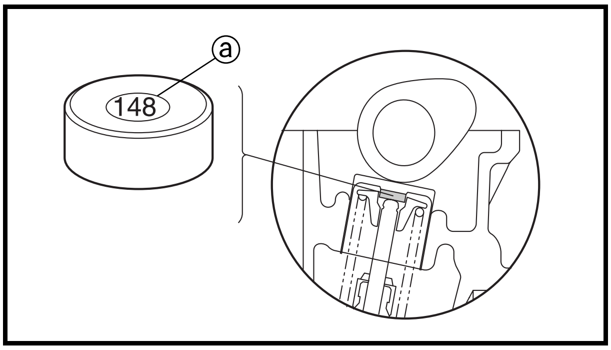
**NOTE:**
Make sure that the tensioner rod has been fully turned clockwise.

6. Remove:
   - Intake camshaft caps
   - Exhaust camshaft caps
   - Timing chain
     (from the camshaft sprockets)
   - Intake camshaft
   - Exhaust camshaft

**NOTE:**
- Refer to “CAMSHAFTS” in Chapter 5.
- When removing the timing chain and camshafts, fasten the timing chain with a wire to prevent it from falling into the crankcase.




7. Adjust:
   - Valve clearance

**Adjustment steps:**
- Remove the valve lifter ① and the valve pad ②.

**NOTE:**
- Cover the timing chain opening with a rag to prevent the valve pad from falling into the crankcase.
- Note the position of each valve lifter ③ and valve pad ④ so that they can be installed in the correct place.

- Select the proper valve pad from the following table.

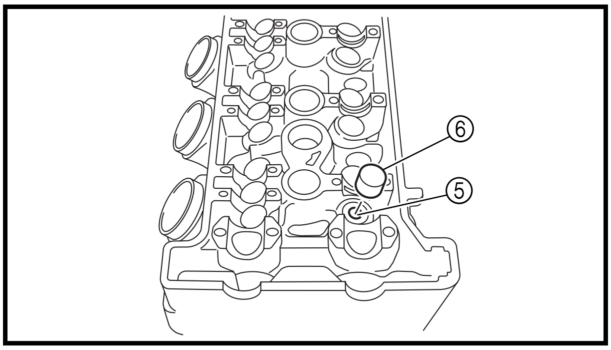
| Valve pad thickness range | | Available valve pads |
|---|---|---|
| Nos. 120–240 | 1.20–2.40 mm | 25 thicknesses in 0.05 mm increments |

**NOTE:**
- The thickness ⓐ of each valve pad is marked in hundredths of millimeters on the side that touches the valve lifter.
- Since valve pads of various sizes are originally installed, the valve pad number must be rounded in order to reach the closest equivalent to the original.

- Round off the original valve pad number according to the following table.

| Last digit | Rounded value |
|---|---|
| 0 or 2 | 0 |
| 5 | 5 |
| 8 | 10 |

**EXAMPLE:**
Original valve pad number = 148 (thickness = 1.48 mm)
Rounded value = 150
- Locate the rounded number of the original valve pad and the measured valve clearance in the valve pad selection table. The point where the column and row intersect is the new valve pad number.




**NOTE:**
The new valve pad number is only an approximation. The valve clearance must be measured again and the above steps should be repeated if the measurement is still incorrect.

- Install the new valve pad ⑤ and the valve lifter ⑥.

**NOTE:**
- Lubricate the valve pad with molybdenum disulfide grease.
- Lubricate the valve lifter with molybdenum disulfide oil.
- The valve lifter must turn smoothly when rotated by hand.
- Install the valve lifter and the valve pad in the correct place.

- Install the exhaust and intake camshafts, timing chain, and camshaft caps.

**Camshaft cap bolt:**
**10 N • m (1.0 kgf • m, 7.2 ft • lb)**

**NOTE:**
- Refer to "Camshaft installation — CAMSHAFTS" in Chapter 5.
- Lubricate the camshafts, camshaft lobes, and camshaft journals.
- Install the exhaust camshaft first.
- Align the camshaft marks with the camshaft cap marks.
- Turn the crankshaft clockwise several full turns to seat the parts.

- Measure the valve clearance again.
- If the valve clearance is still out of specification, repeat all of the valve clearance adjustment steps until the specified clearance is obtained.

### Intake

| MEASURED CLEARANCE | ORIGINAL VALVE PAD NUMBER | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 |
| 0.00–0.02 | | | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 |
| 0.03–0.07 | | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 |
| 0.08–0.10 | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 |
| 0.11–0.20 | STANDARD CLEARANCE | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.21–0.22 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | |
| 0.23–0.27 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | |
| 0.28–0.32 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | |
| 0.33–0.37 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | |
| 0.38–0.42 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | |
| 0.43–0.47 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | |
| 0.48–0.52 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | |
| 0.53–0.57 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | |
| 0.58–0.62 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | |
| 0.63–0.67 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | |
| 0.68–0.72 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | |
| 0.73–0.77 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | |
| 0.78–0.82 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | |
| 0.83–0.87 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | |
| 0.88–0.92 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | |
| 0.93–0.97 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | |
| 0.98–1.02 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | |
| 1.03–1.07 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | |
| 1.08–1.12 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | | |
| 1.13–1.17 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | | | |
| 1.18–1.22 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | | | | |
| 1.23–1.27 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | | | | | |
| 1.28–1.32 | 235 | 240 | | | | | | | | | | | | | | | | | | | | | | | |
| 1.33–1.37 | 240 | | | | | | | | | | | | | | | | | | | | | | | | |

Example:
Intake valve clearance (cold)
 0.11–0.20 mm (0.0043–0.0079 in)
Rounded value 150
 Measured valve clearance is 0.24 mm (0.0094 in)
Replace pad 150 with pad 160
 Pad No. 150 = 1.50 mm (0.0591 in)
 Pad No. 160 = 1.60 mm (0.0630 in)

### Exhaust

| MEASURED CLEARANCE | ORIGINAL VALVE PAD NUMBER | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 |
| 0.00–0.01 | | | | | | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 |
| 0.02–0.06 | | | | | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 |
| 0.07–0.11 | | | | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 |
| 0.12–0.16 | | | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 |
| 0.17–0.21 | | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 |
| 0.22–0.24 | | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 |
| 0.25–0.34 | STANDARD CLEARANCE | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.35–0.37 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | |
| 0.38–0.42 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | |
| 0.43–0.47 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | |
| 0.48–0.52 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | |
| 0.53–0.57 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | |
| 0.58–0.62 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | |
| 0.63–0.67 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | |
| 0.68–0.72 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | |
| 0.73–0.77 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | |
| 0.78–0.82 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | |
| 0.83–0.87 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | |
| 0.88–0.92 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | |
| 0.93–0.97 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | |
| 0.98–1.02 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | |
| 1.03–1.07 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | |
| 1.08–1.12 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | |
| 1.13–1.17 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | |
| 1.18–1.22 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | |
| 1.23–1.27 | 215 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | | |
| 1.28–1.32 | 220 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | | | |
| 1.33–1.37 | 225 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | | | | |
| 1.38–1.42 | 230 | 235 | 240 | | | | | | | | | | | | | | | | | | | | | | |
| 1.43–1.47 | 235 | 240 | | | | | | | | | | | | | | | | | | | | | | | |
| 1.48–1.52 | 240 | | | | | | | | | | | | | | | | | | | | | | | | |

Example:
Exhaust valve clearance (cold)
 0.25–0.34 mm (0.0098–0.0134 in)
Rounded value 170
 Measured valve clearance is 0.44 mm (0.0173 in)
Replace pad 170 with pad 185
 Pad No. 170 = 1.70 mm (0.0669 in)
 Pad No. 185 = 1.85 mm (0.0728 in)

8. Remove:
   - Dial gauge
   - Dial gauge stand
   - Dial gauge needle

9. Install:
   - All removed parts

**NOTE:**
For installation, reverse the removal procedure.

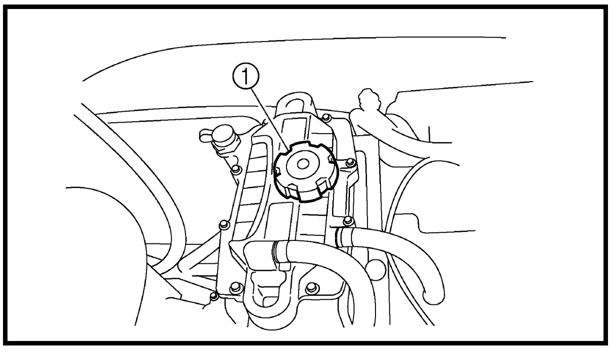
**Engine oil level check**

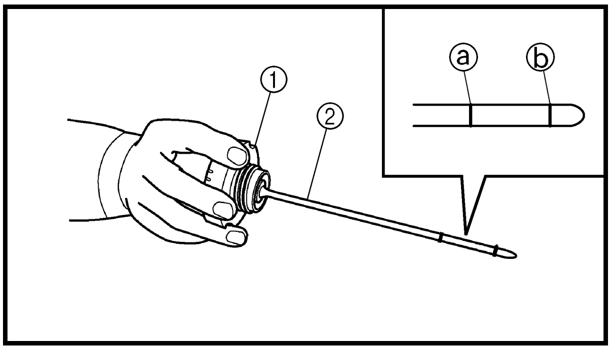
1. Check:
   - Engine oil level

**Checking steps:**

**CAUTION:**

- **When checking the engine oil level on water, be careful of other watercraft, boats, swimmers, or obstacles. The water current or wind can cause the watercraft to move and lead to a collision.**
- **When checking the engine oil level on land, supply water to the cooling water passages.**
- **Make sure that engine has enough oil but do not overfill. If there is too little oil, the engine can be damaged. If there is too much oil, the air filter can become saturated with oil, permanently damaging the filter and reducing engine performance. Follow the checking procedure carefully.**
- **Make sure that debris or water does not enter the oil tank filler hole. Debris or water in the engine oil can cause serious engine damage.**




- Place the watercraft in a horizontal position or launch the watercraft.
- Remove the seat.
- Remove the oil tank filler cap ① and check for oil on the dipstick ②.
- If there is no oil on the dipstick, pour enough oil so that the tip of the dipstick comes into contact with the oil, and then install the filler cap.
- Start the engine.

**CAUTION:**

**When starting the engine make sure the dipstick is securely fitted into the oil tank.**

**NOTE:**
- The engine cannot be started if the Yamaha Security System is in the lock mode. (Deluxe model only)
- For information on the Yamaha Security System, see the owner's manual. (Deluxe model only)

- Run the engine at trolling speed for 6 minutes or more, and then turn the engine off.

**CAUTION:**

**When checking the oil level on land, be sure to connect a garden hose to the watercraft for proper water supply.**

**NOTE:**
If the ambient temperature is 20 °C (68 °F) or less, warm up the engine for an additional 5 minutes.

- Remove the oil tank filler cap ①, wipe the dipstick ② clean, and then screw the filler cap into the filler hole completely.

- Remove the oil tank filler cap again and check that the oil level is between the minimum level mark ⓐ and maximum level mark ⓑ on the dipstick.
- If the engine oil is below the minimum level mark ⓑ, add sufficient oil of the recommended type to raise it to the correct level.
- If the engine oil is above the maximum level mark ⓐ, extract sufficient oil using an oil changer to lower it to the correct level.

**NOTE:**
If the oil temperature is low, the reading on the dipstick will be low, and if the temperature is high, the reading on the dipstick will be high.

**Engine oil change — using oil changer**

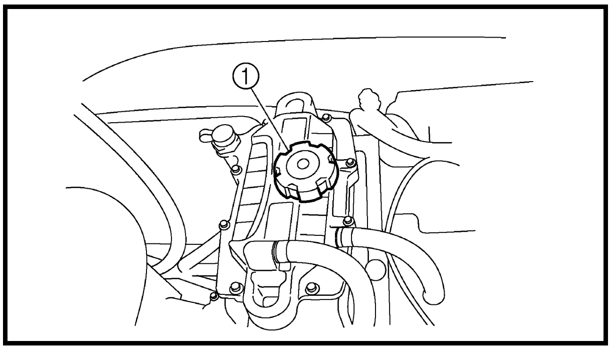
**⚠ WARNING**

**Avoid changing the engine oil immediately after turning the engine off. The oil is hot and should be handled with care to avoid burns.**

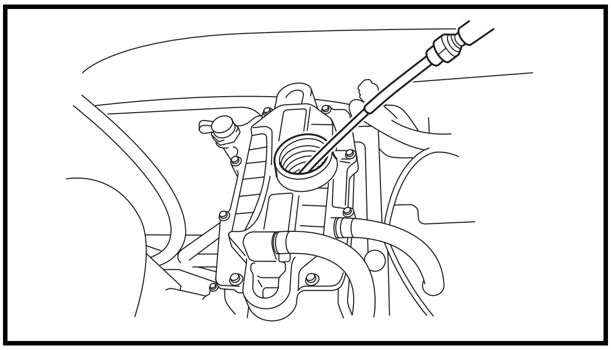
**CAUTION:**

- **Do not run the engine with too much or not enough oil in the oil tank. Oil could spray out or the engine could be damaged.**
- **Do not run the engine for more than 15 seconds without supplying water, when checking the oil level on land.**
  **The engine could overheat.**
- **Be sure to change the engine oil after the first 10 hours of operation, and every 100 hours thereafter or at the start of a new season, otherwise the engine will wear quickly.**

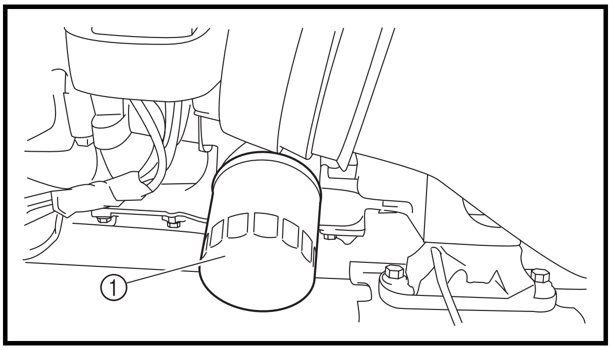
1. Warm the engine up, and then put the watercraft in a horizontal position.

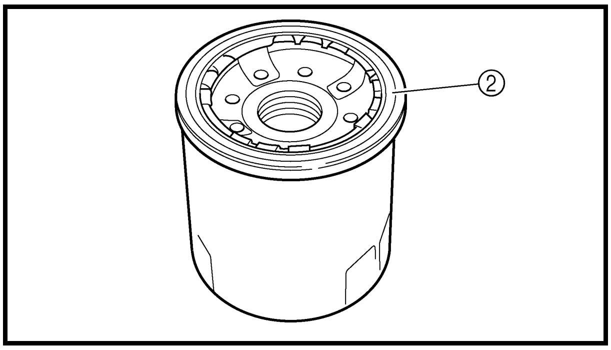



2. Remove:
   - Oil tank filler cap ①



3. Insert the tube of an oil changer into the oil filler hole.
4. Operate the oil changer to extract the oil.




5. If the oil filter is also to be replaced, perform the following procedure.

**Replacing steps:**
- Place a rag under the oil filter.
- Remove the oil filter ① with an oil filter wrench.

**Oil filter wrench:**
**YB-01426/90890-01426**

- Lubricate the O-ring ② of the new oil filter with a thin coat of engine oil.

**CAUTION:**

**Make sure the O-ring ② is positioned correctly in the groove of the oil filter.**

- Tighten the new oil filter to specification with an oil filter wrench.

**Oil filter:**
**17 N • m (1.7 kgf • m, 12 ft • lb)**

6. Pour the specified amount of the recommended engine oil into the oil filler hole.

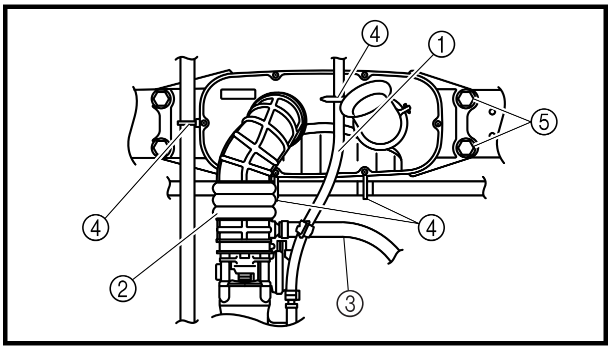
7. Fill:
   - Oil tank
     (with the specified amount of the recommended engine oil)

> **Recommended oil:**
> **SAE 10W-30, 20W-40, 20W-50**
> **API SE, SF, SG, SH, SJ, SL**
> **Oil quantity:**
> **Total amount:**
> **4.3 L (4.5 US qt, 3.8 Imp qt)**
> **Without oil filter replacement:**
> **2.0 L (2.1 US qt, 1.8 Imp qt)**
> **With oil filter replacement:**
> **2.2 L (2.3 US qt, 1.9 Imp qt)**

**CAUTION:**

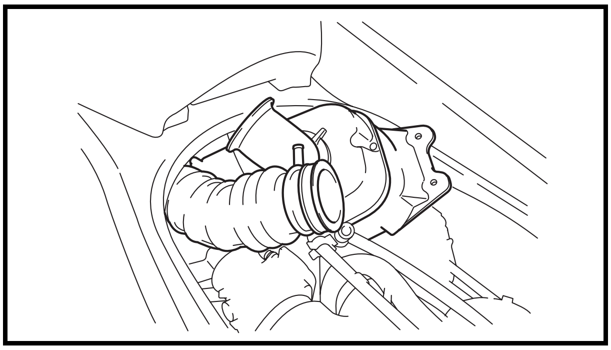
**When starting the engine make sure the dipstick is securely fitted into the oil tank.**

8. Install:
   - Oil tank filler cap

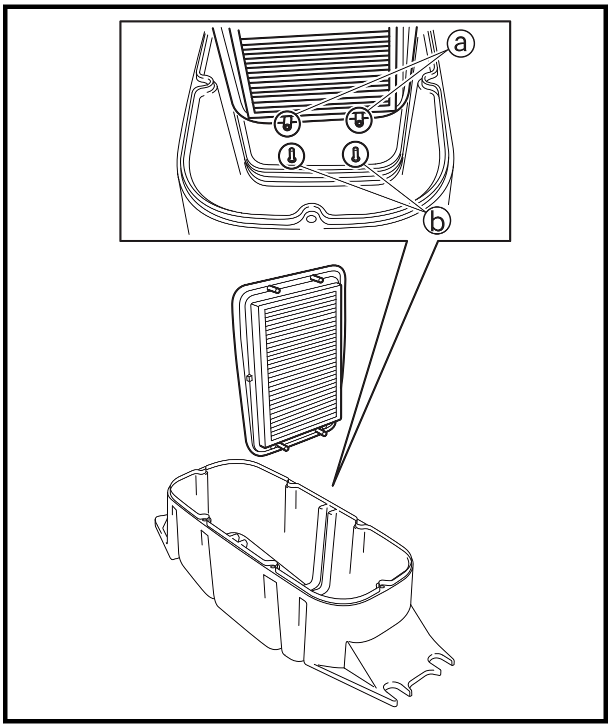



**Air filter element clean**

1. Disconnect:
   - Fuel hose ①
   - Air intake hose ②
   - Oil separator breather hose ③
2. Remove:
   - Plastic ties ④
   - Bolts ⑤



3. Remove:
   - Air filter case
4. Remove:
   - Air filter case cover




5. Remove the air filter element and check it for dirt and oil. Replace the air filter element if there is any oil buildup.

**CAUTION:**

- **Do not start the engine with the air filter case removed, otherwise the engine could be damaged.**
- **If cleaning the air filter element, use cold or lukewarm water and let it air dry completely. Do not use detergent or a solvent to clean the air filter element, or dry it with heat or compressed air, otherwise it could be damaged.**

6. Install:
   - Air filter element

**NOTE:**
Install the air filter element with its projections ⓐ facing away from the projections ⓑ on the air filter case.

7. Install:
   - Air filter case cover

**Air filter case cover screw (short):**
**1.5 N • m (0.15 kgf • m, 1.1 ft • lb)**
**LOCTITE 572**
**Air filter case cover screw (long):**
**1.2 N • m (0.12 kgf • m, 0.9 ft • lb)**
**LOCTITE 572**

8. Install:
   - Air filter case

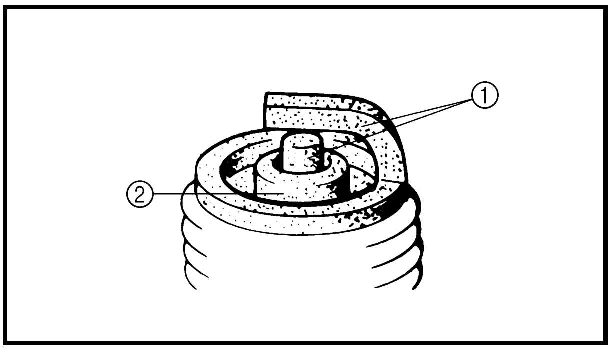
**Air filter case:**
**17 N • m (1.7 kgf • m, 12 ft • lb)**

**Spark plug inspection**

1. Remove:
   - Ignition coils

**CAUTION:**

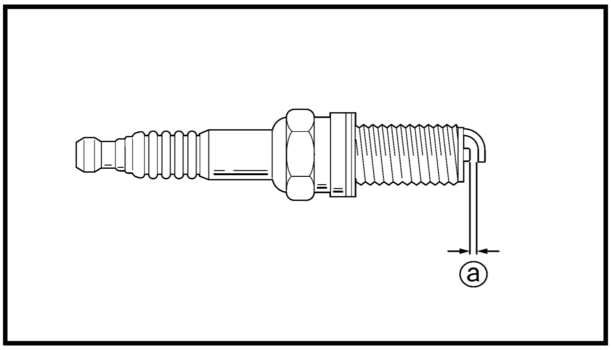
**Be careful not to get any foreign substances or water in spark plug hole.**




2. Inspect:
   - Electrodes ①
     Damage/wear → Replace.
   - Insulator color ②
     Distinctly different color → Check the engine condition.

**Color guide:**
**Medium to light tan color:**
**Normal**
**Whitish color:**
**Lean fuel mixture**
**Air leak**
**Incorrect settings**
**Blackish color:**
**Overly rich mixture**
**Electrical malfunction**
**Defective spark plug**

3. Clean:
   - Spark plug
     (with a spark plug cleaner or wire brush)

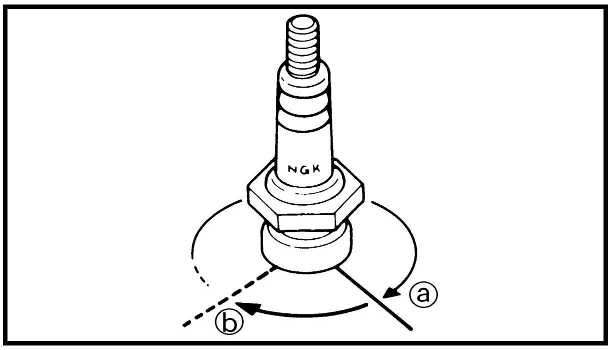



4. Measure:
   - Spark plug gap ⓐ
     Out of specification → Regap.

**Spark plug gap:**
**0.7–0.8 mm (0.028–0.031 in)**

5. Tighten:
   - Spark plug

| | |
|---|---|
| | **Spark plug:**<br>**13 N • m (1.3 kgf • m, 9.4 ft • lb)** |




**NOTE:**
- Before installing the spark plug, clean the gasket surface and spark plug surface. Also, it is suggested to apply a thin film of anti-seize compound to the spark plug threads to prevent thread seizure.
- If a torque wrench is not available, a good estimate of the correct tightening torque for a new spark plug is to finger tighten ⓐ the spark plug and then tighten it another 1/4 to 1/2 of a turn ⓑ.

6. Install:
   - Ignition coils

| | |
|---|---|
| | **Ignition coil bolt:**<br>**7.6 N • m (0.76 kgf • m, 5.5 ft • lb)**<br>**LOCTITE 572** |

## ELECTRICAL

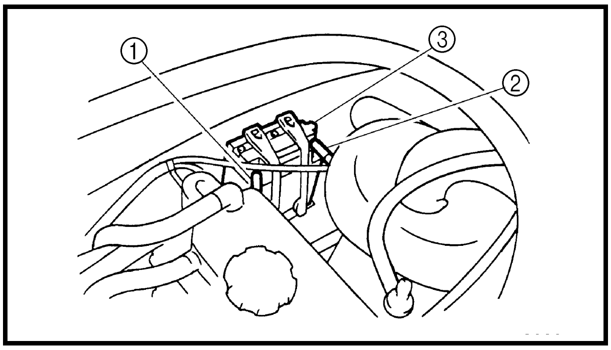
### Battery inspection

**⚠ WARNING**

**Battery electrolyte is poisonous and dangerous, causing severe burns, etc. Electrolyte contains sulfuric acid. Avoid contact with skin, eyes or clothing.**
**Antidotes**
**External: Flush with water.**
**Internal: Drink large quantities of water or milk. Follow with milk of magnesia, beaten egg or vegetable oil. Call physician immediately.**
**Eyes: Flush with water for 15 minutes and get prompt medical attention.**
**Batteries produce explosive gases. Keep sparks, flame, cigarettes, etc., well away. If using or charging the battery in an enclosed space, make sure that it is well ventilated. Always shield your eyes when working near batteries.**
**KEEP OUT OF THE REACH OF CHILDREN.**

**CAUTION:**

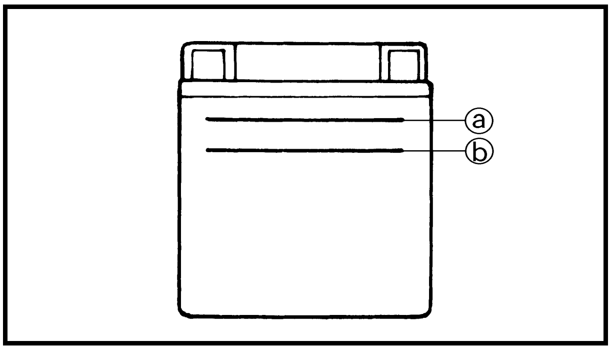
**Be careful not to place the battery on its side.**
**Make sure to remove the battery from the battery compartment when adding battery electrolyte or charging the battery.**
**When checking the battery, make sure the breather hose is connected to the battery and not obstructed.**




1. Remove:
   - Bands
   - Battery negative lead ①
   - Battery positive lead ②
   - Battery
   - Battery breather hose ③

**⚠ WARNING**

- **When removing the battery, disconnect the negative lead first.**
- **Remove the battery to prevent acid loss during turning the watercraft on its side for the impeller, etc.**




2. Inspect:
   - Electrolyte level
     Low → Add distilled water.
     The electrolyte level should be between the maximum ⓐ and minimum ⓑ level marks.

**Filling steps:**
- Remove each filler cap.
- Add distilled water to the maximum level mark.
- When the electrolyte level reaches the maximum level mark, allow the cell to stand for 20 minutes. If the electrolyte level drops, add more distilled water so the level reaches the maximum level mark.

**CAUTION:**

**Use only distilled water. Other types of water contain minerals which are harmful to batteries.**

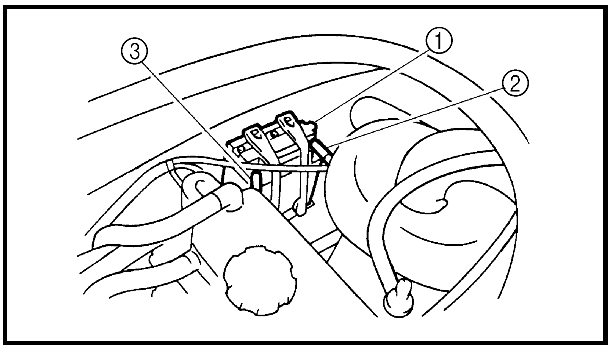
3. Inspect:
   - Specific gravity
     Out of specification → Charge.

**Specific gravity at 20 °C (68 °F):**
**1.28**
**Charging current:**
**1.9 A × 10 h**

4. Install:
   - Filler caps

**CAUTION:**

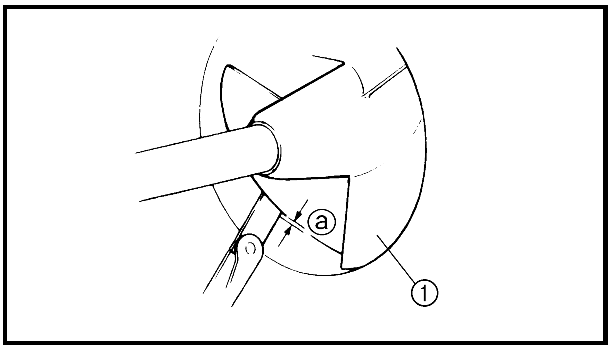
**Before installation, rinse off any fluid from the battery box and battery and make sure that the battery is dry before installing it.**




5. Install:
   - Battery breather hose ①
   - Battery
   - Battery positive lead ②
   - Battery negative lead ③
   - Bands

**CAUTION:**

- **Connect the positive lead to the battery terminal first.**
- **Make sure the battery leads are connected properly. Reversing the leads can seriously damage the electrical system.**
- **Make sure that the battery breather hose is properly connected and is not obstructed.**
- **Coat the terminals with a water resistant grease to minimize terminal corrosion.**



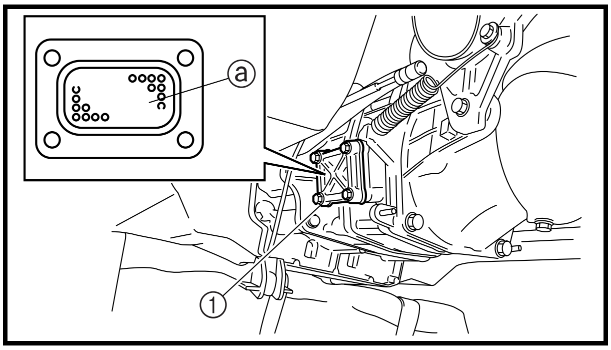

## JET PUMP UNIT

### Impeller inspection

1. Check:
   - Impeller ①
     Damage/wear → Replace.
     Nicks/scratches → File or grind.
2. Measure:
   - Impeller-to-housing clearance ⓐ
     Out of specification → Replace.

**Maximum impeller-to-housing clearance:**
**0.35–0.45 mm (0.0138–0.0177 in)**

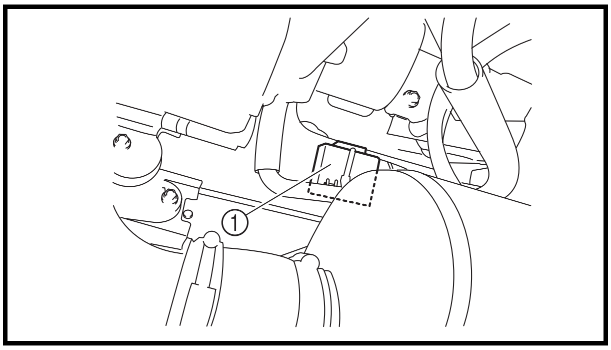
**Measurement steps:**
- Remove the battery leads.
- Remove the intake grate and intake duct. Refer to “INTAKE GRATE AND RIDE PLATE” in Chapter 6.
- Measure the clearance at each impeller blade as shown (a total of three measurements).
- Install the intake duct and intake grate. Refer to “INTAKE GRATE AND RIDE PLATE” in Chapter 6.
- Install the battery leads.

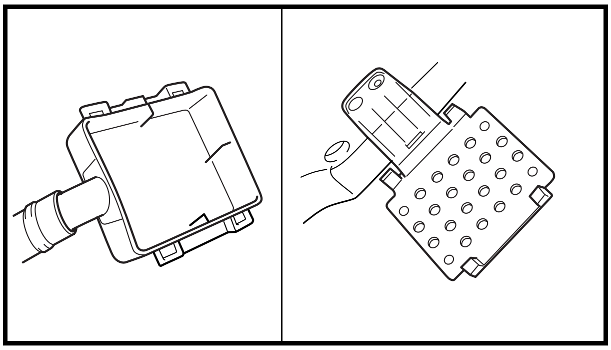



### Water inlet strainer inspection

1. Inspect:
   - Water inlet strainer
     Contaminants → Clean.
     Cracks/damage → Replace.

**Inspection steps:**
- Remove the ride plate.
  Refer to “INTAKE GRATE AND RIDE PLATE” in Chapter 6.
- Remove the rubber plate.
  Refer to “JET PUMP UNIT” in Chapter 6.
- Remove the water inlet cover ①.
- Inspect the water inlet strainer mesh ⓐ.
- Install the water inlet cover.
- Install the rubber plate.
  Refer to “JET PUMP UNIT” in Chapter 6.
- Install the ride plate.
  Refer to “INTAKE GRATE AND RIDE PLATE” in Chapter 6.

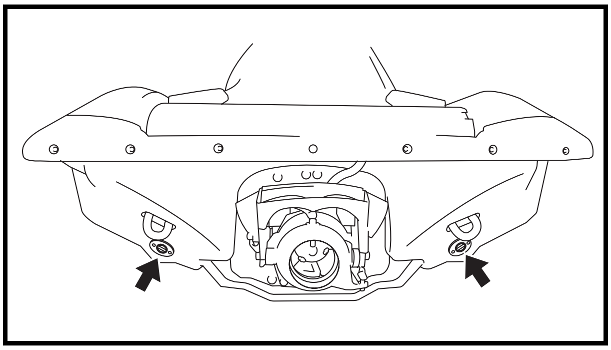


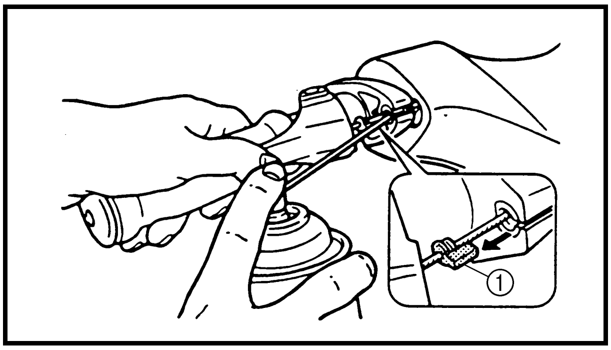



## BILGE PUMP

### Bilge strainer inspection

1. Inspect:
   - Bilge strainer ①
     Contaminants → Clean.
     Cracks/damage → Replace.






## GENERAL

### Drain plug inspection

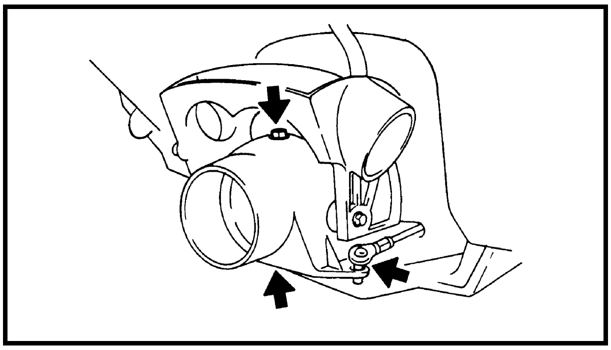
1. Inspect:
   - Drain plugs
     Cracks/damage → Replace.
   - O-rings
     Cracks/wear → Replace.
   - Screw threads
     Contaminants → Clean.

### Lubrication points

1. Lubricate:
   - Throttle cable (handlebar end)

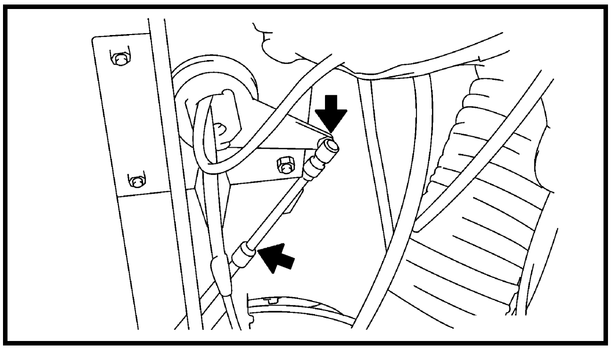
| | **Recommended lubricant:** **Rust inhibitor** |
|---|---|

**NOTE:**
Before lubricating the throttle cable, squeeze the throttle lever and remove the rubber seal ①.



2. Lubricate:
   - Nozzle pivot shaft
   - Steering cable (nozzle end)

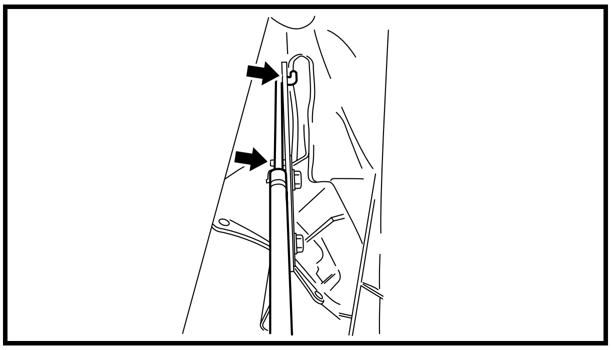
**Recommended grease:**
**Yamaha marine grease,**
**Yamaha grease A**
**(Water resistant grease)**

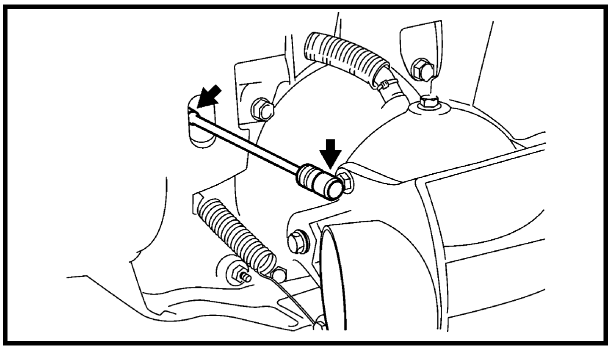


3. Lubricate:
   - Steering cable
   - Steering cable joint

**NOTE:**
Disconnect the joints and apply a small amount of grease.

**Recommended grease:**
**Yamaha marine grease,**
**Yamaha grease A**
**(Water resistant grease)**





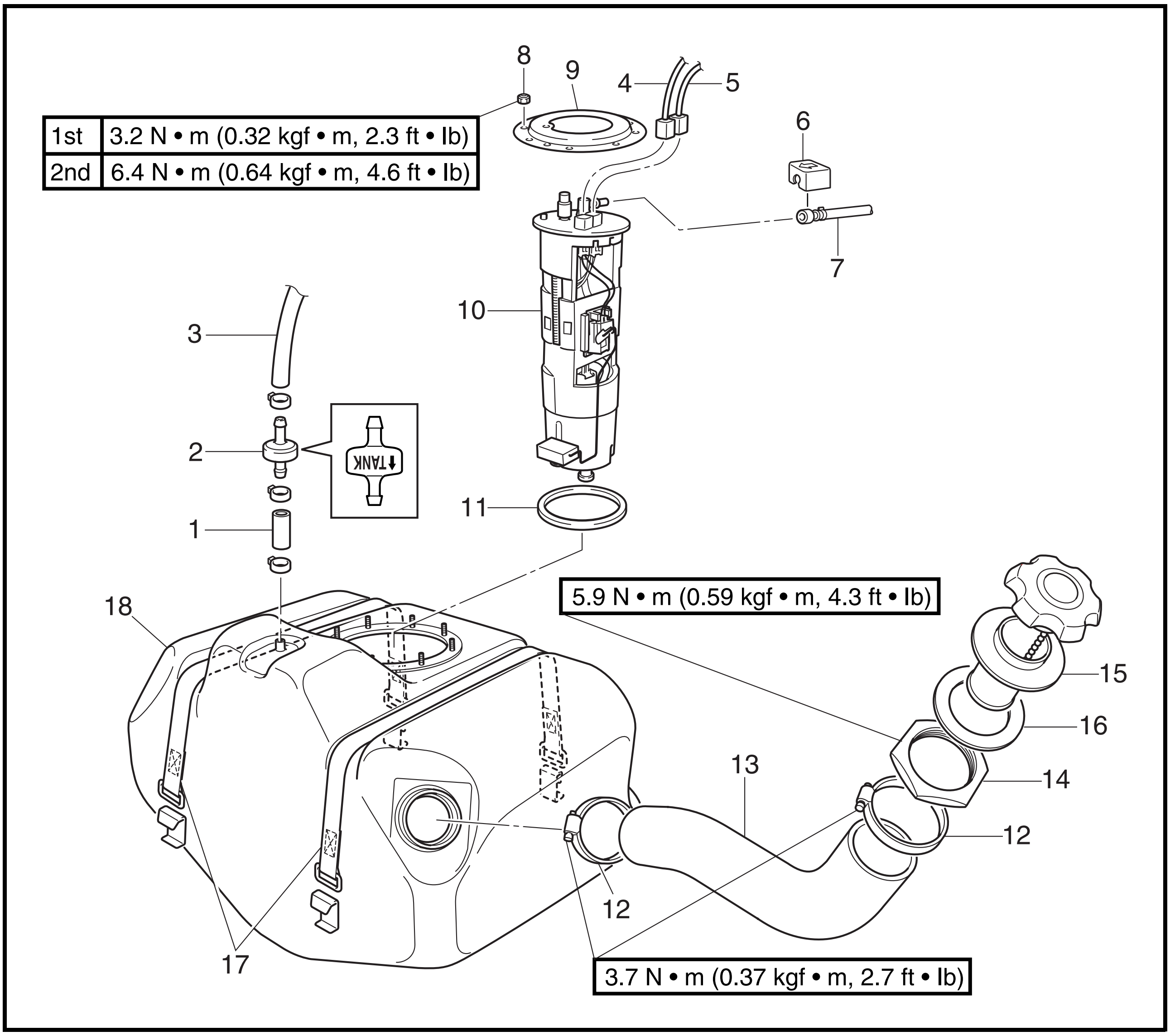
4. Lubricate: (Deluxe model only)
   - Shift cable (shift lever end)
   - Shift cable (reverse gate end)
   - Shift cable joint

**NOTE:**
Disconnect the joints and apply a small amount of grease.

**Recommended grease:**
**Yamaha marine grease,**
**Yamaha grease A**
**(Water resistant grease)**

# CHAPTER 4
# FUEL SYSTEM

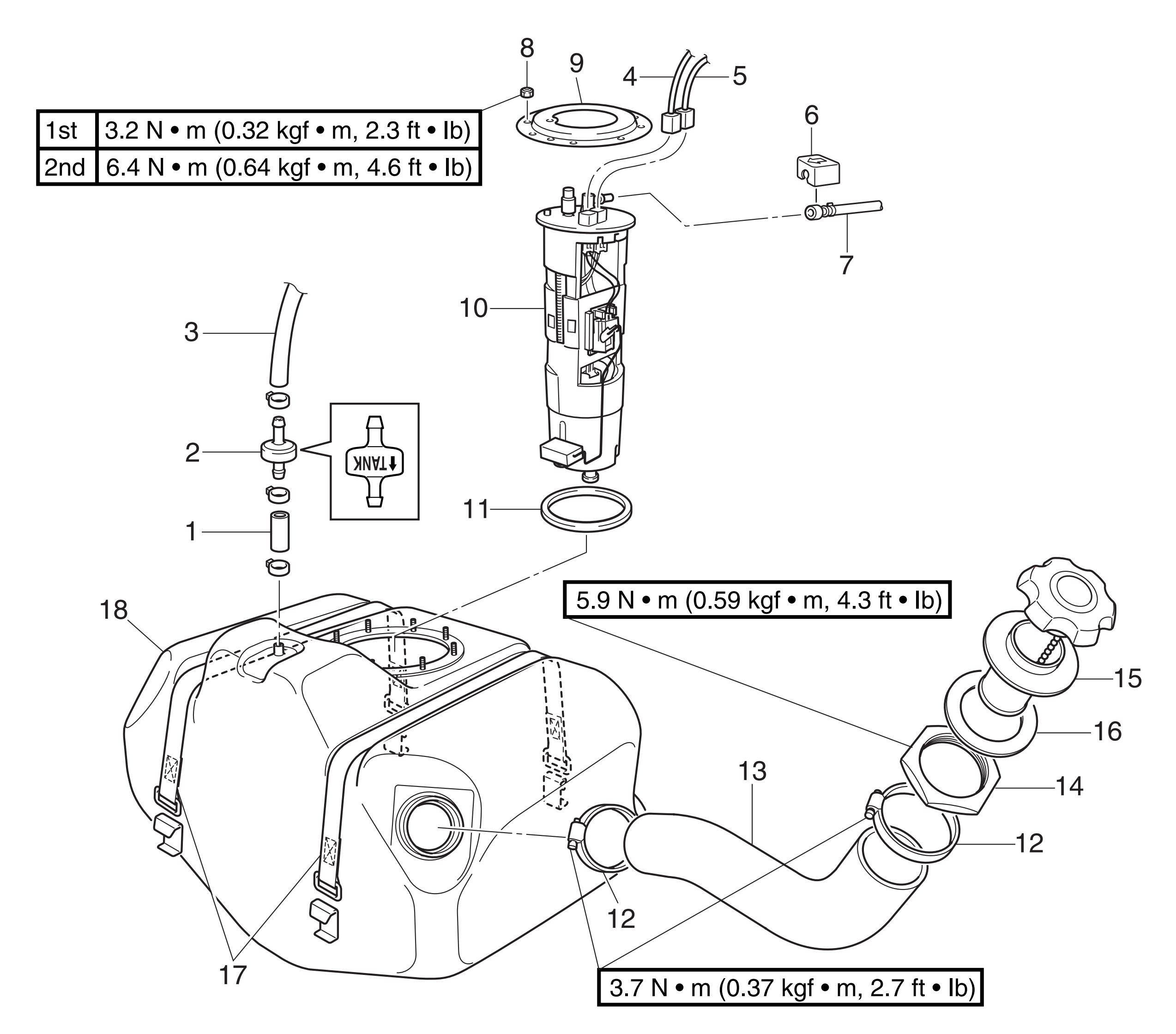
# FUEL TANK AND FUEL PUMP MODULE
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

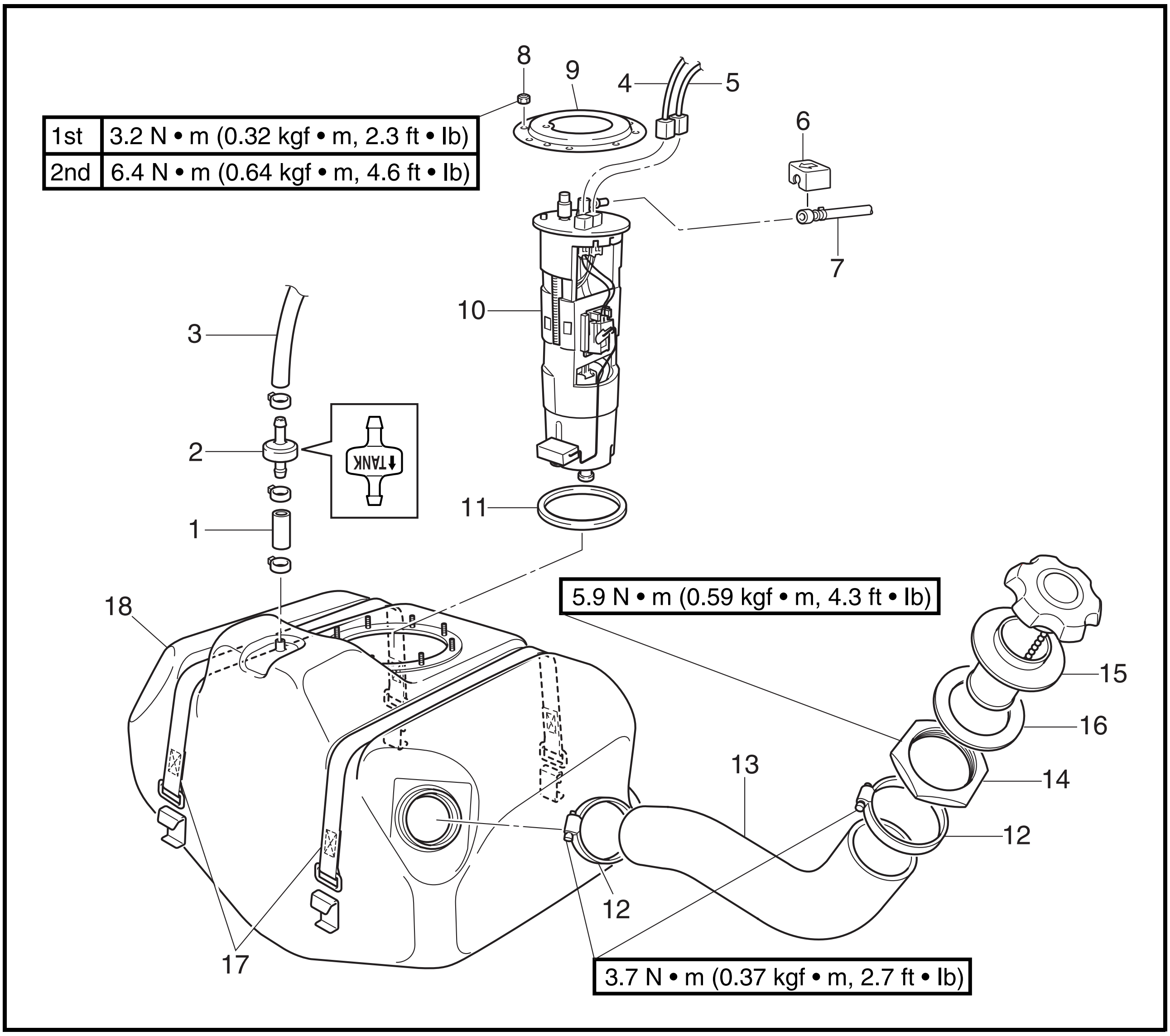
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **FUEL TANK REMOVAL** | | Follow the left "Step" for removal. |
| | Storage compartment panel | | Refer to "FRONT HOOD" in Chapter 8. |
| | Ventilation hose | | From ventilation fitting |
| | Engine unit | | Refer to "ENGINE UNIT" in Chapter 5.<br>**NOTE:**<br>When removing the pump module only, it is not necessary to remove the engine unit. |
| 1 | Fuel tank breather hose | 1 | |
| 2 | Check valve | 1 | **NOTE:**<br>Make sure the arrow direction pointed toward fuel tank. |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 3 | Fuel tank breather hose | 1 | **NOTE:** |
| 4 | Fuel sender coupler | 1 | Make sure that the inner seal of the coupler is installed properly before connecting the coupler. |
| 5 | Fuel pump module coupler | 1 | |
| 6 | Cover | 1 | |
| 7 | Fuel hose | 1 | |
| 8 | Nut | 9 | |
| 9 | Retainer | 1 | |
| 10 | Fuel pump module | 1 | |
| 11 | Packing | 1 | |

## EXPLODED DIAGRAM

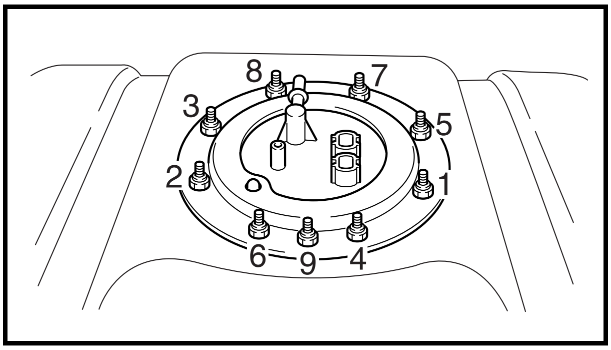



| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 12 | Hose clamp | 2 | |
| 13 | Fuel filler hose | 1 | |
| 14 | Nut | 1 | |
| 15 | Fuel filler neck | 1 | |
| 16 | Rubber seal | 1 | |
| 17 | Fuel tank belt | 2 | |
| 18 | Fuel tank assembly | 1 | |
| | | | Reverse the removal steps for installation. |

## SERVICE POINTS

### Fuel hose disconnection

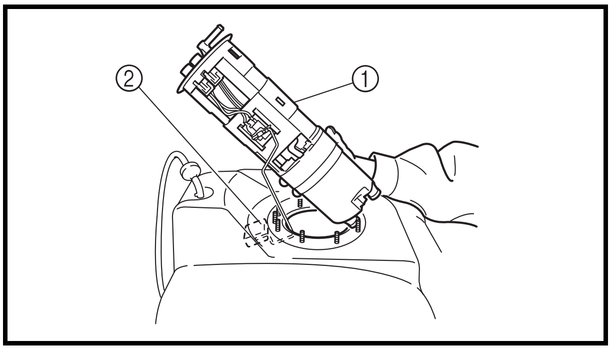
1. Disconnect:
   - Fuel hose
     Refer to “FUEL INJECTION SYSTEM”.




### Fuel pump module removal

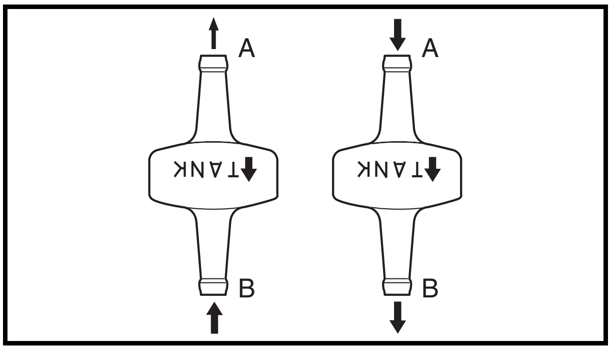
1. Remove:
   - Nuts
   - Retainer

**NOTE:**
Loosen the nuts in the sequence shown.




2. Remove:
   - Fuel pump module ①

**NOTE:**
Remove the float ② at an angle because it could catch on the fuel tank.




### Check valve inspection

1. Check:
   - Check valve
     Faulty → Replace.

**Checking steps:**
- Connect a hose to the end of check valve “A” and blow into it.
  Air should come out from end “B”.
- Connect the hose to the end of check valve “B” and blow into it.
  Air should come out from end “A”.

**Fuel sender inspection**

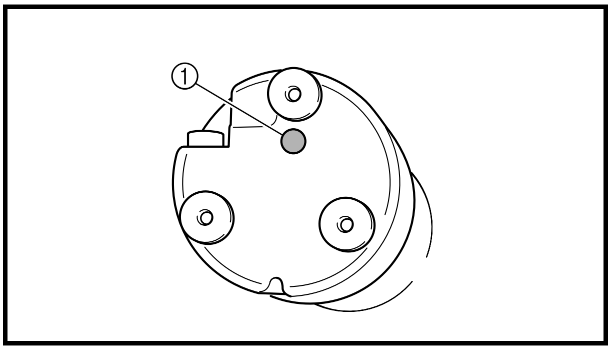
Refer to “FUEL CONTROL SYSTEM” in Chapter 7.

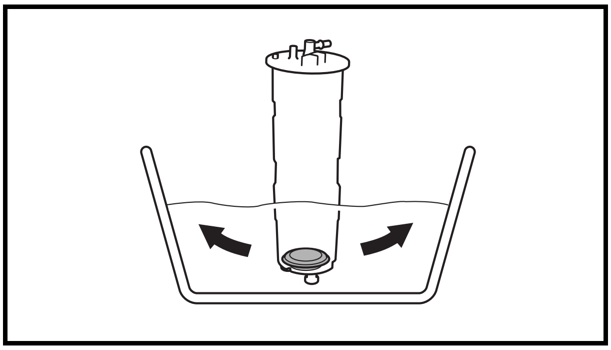
**Fuel tank inspection**

1. Inspect:
   - Fuel tank
     Cracks/damage → Replace.

**Fuel hose inspection**

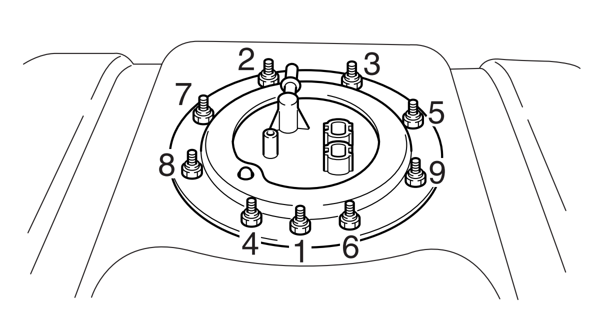
Refer to “FUEL INJECTION SYSTEM”.



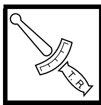
**Fuel pump filter inspection**

1. Inspect:
   - Fuel pump filter ①
     Clog/contaminants → Wash the fuel pump filter in kerosene or gasoline.




**Fuel pump module installation**

1. Tighten:
   - Nuts



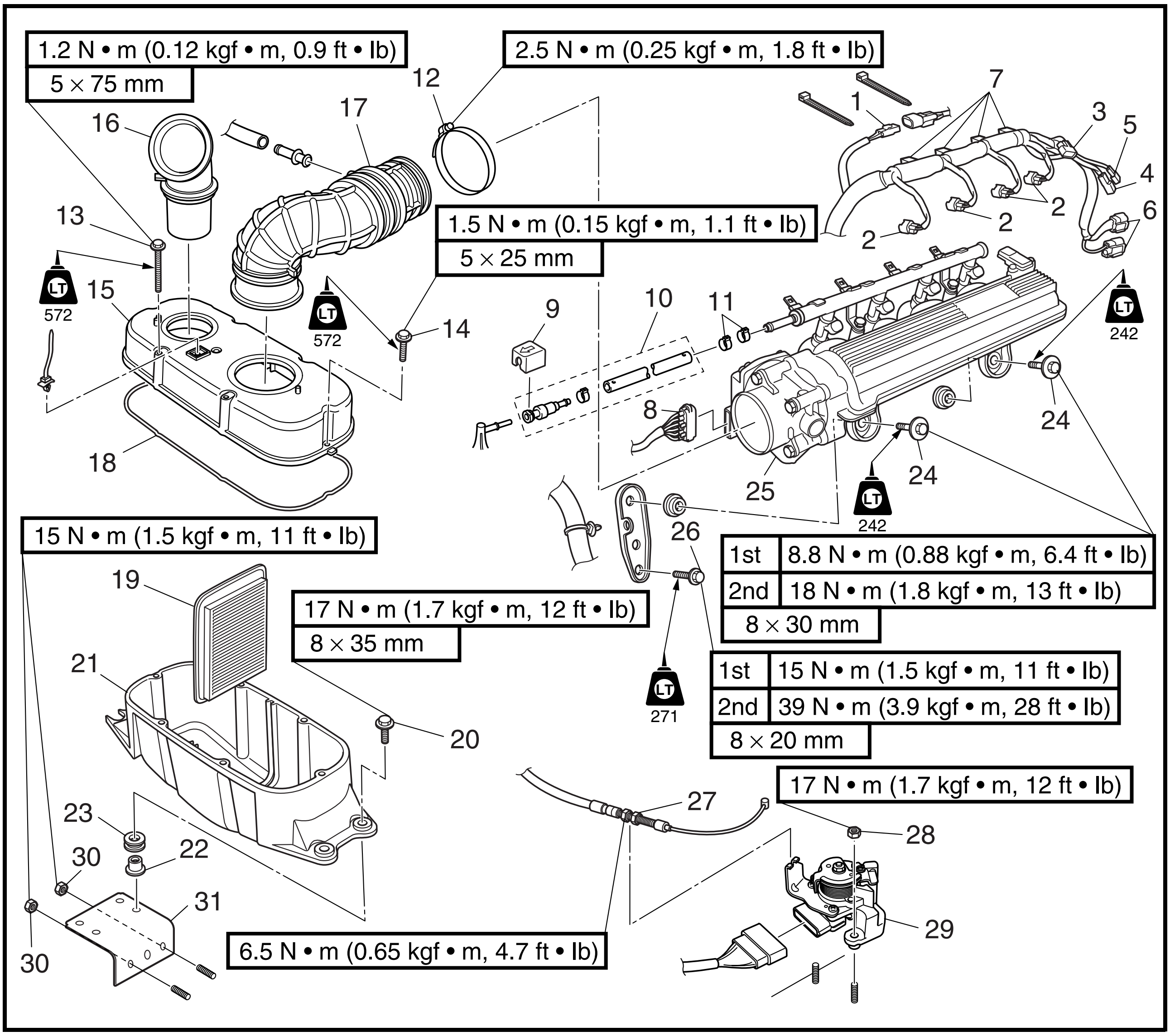
**Fuel pump module nut:**
**1st:**
**3.2 N • m**
**(0.32 kgf • m, 2.3 ft • lb)**
**2nd:**
**6.4 N • m**
**(0.64 kgf • m, 4.6 ft • lb)**

**NOTE:**
Tighten the nuts in the sequence shown.

**Fuel hose connect**

Refer to “FUEL INJECTION SYSTEM”.

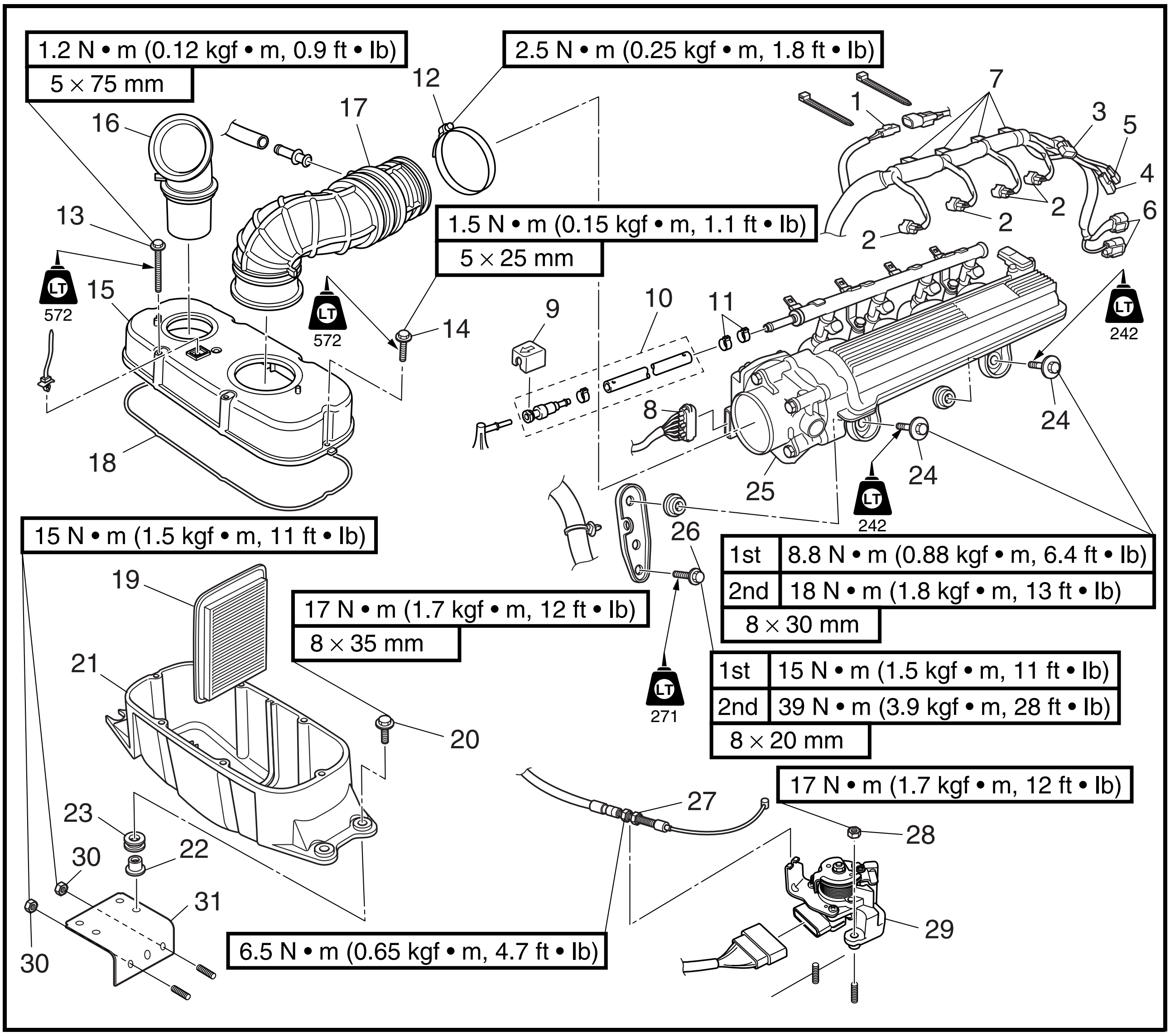
# FUEL INJECTION SYSTEM
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

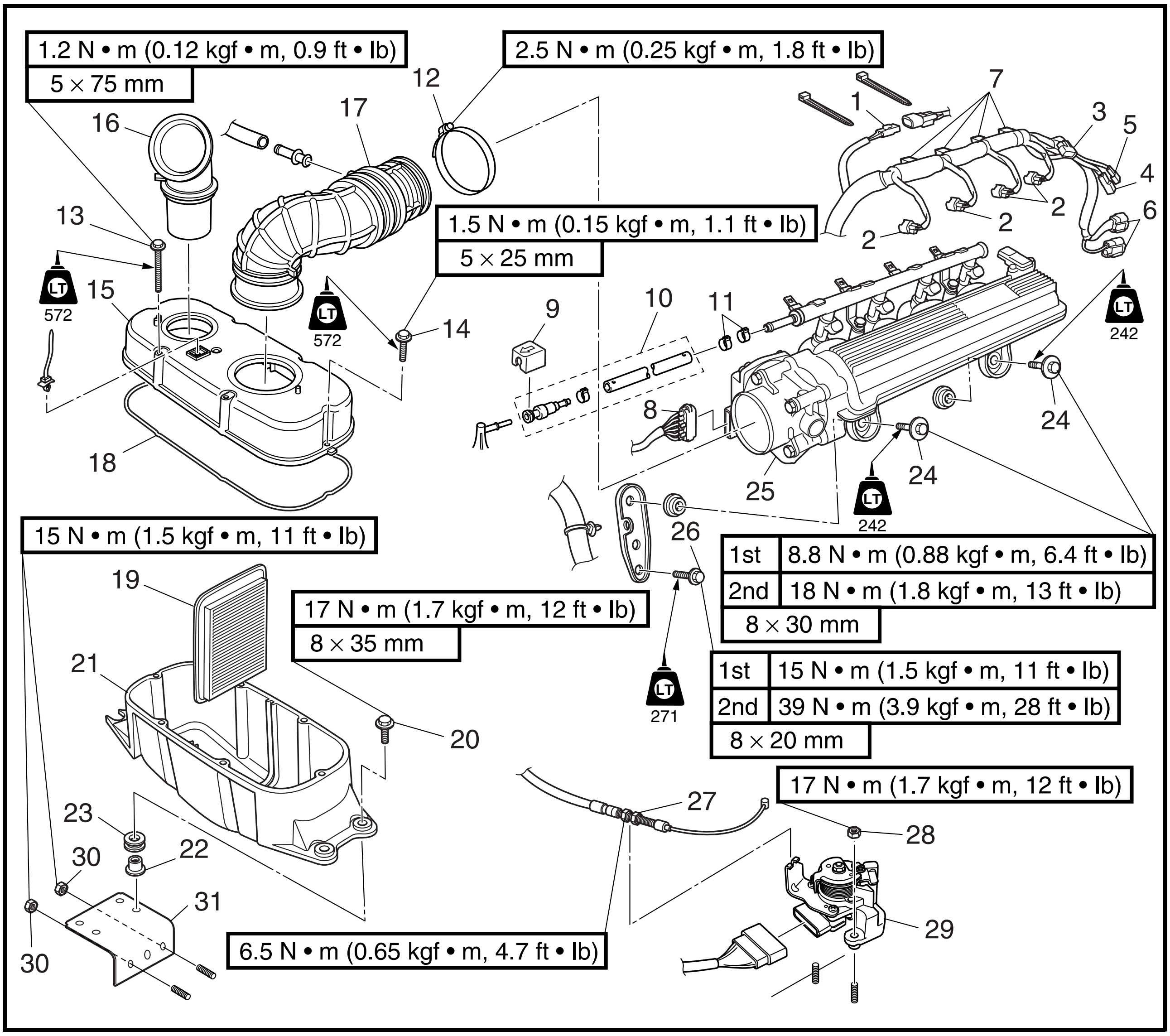
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **FUEL INJECTION SYSTEM REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Cam position sensor coupler | 1 | |
| 2 | Fuel injector coupler | 4 | |
| 3 | Sensor assembly coupler | 1 | |
| 4 | Thermoswitch coupler (exhaust) | 1 | |
| 5 | Oil pressure switch coupler | 1 | |
| 6 | Ground lead coupler | 2 | |
| 7 | Joint connector | 4 | From fuel rail |
| 8 | Throttle body assembly coupler | 1 | |
| 9 | Cover | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 10 | Fuel hose | 1 | |
| 11 | Clamp | 2 | **Not reusable** |
| 12 | Hose screw clamp | 1 | |
| 13 | Screw | 2 | |
| 14 | Screw | 4 | |
| 15 | Air filter case cover | 1 | |
| 16 | Air intake duct | 1 | |
| 17 | Air intake hose | 1 | |
| 18 | Gasket | 1 | |
| 19 | Air filter element | 1 | |
| 20 | Bolt | 4 | |

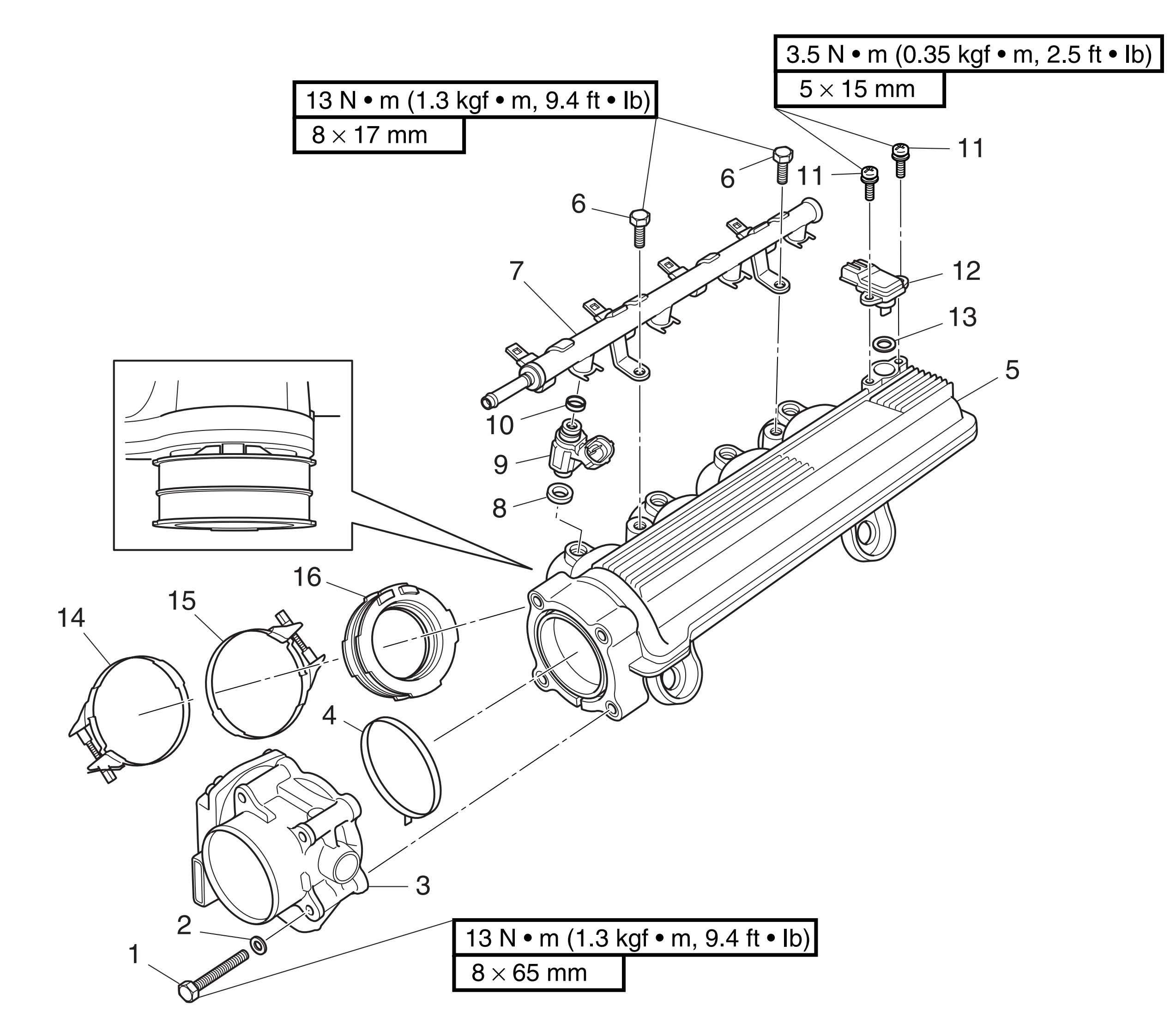
## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 21 | Air filter case | 1 | |
| 22 | Collar | 4 | |
| 23 | Grommet | 4 | |
| 24 | Bolt | 2 | |
| 25 | Intake assembly | 1 | |
| 26 | Bolt | 2 | |
| 27 | Throttle cable | 1 | |
| 28 | Nut | 2 | |
| 29 | Accelerator position sensor | 1 | |
| 30 | Nut | 4 | |
| 31 | Bracket | 2 | |
| | | | Reverse the removal steps for installation. |

# THROTTLE BODY ASSEMBLY AND INTAKE MANIFOLD

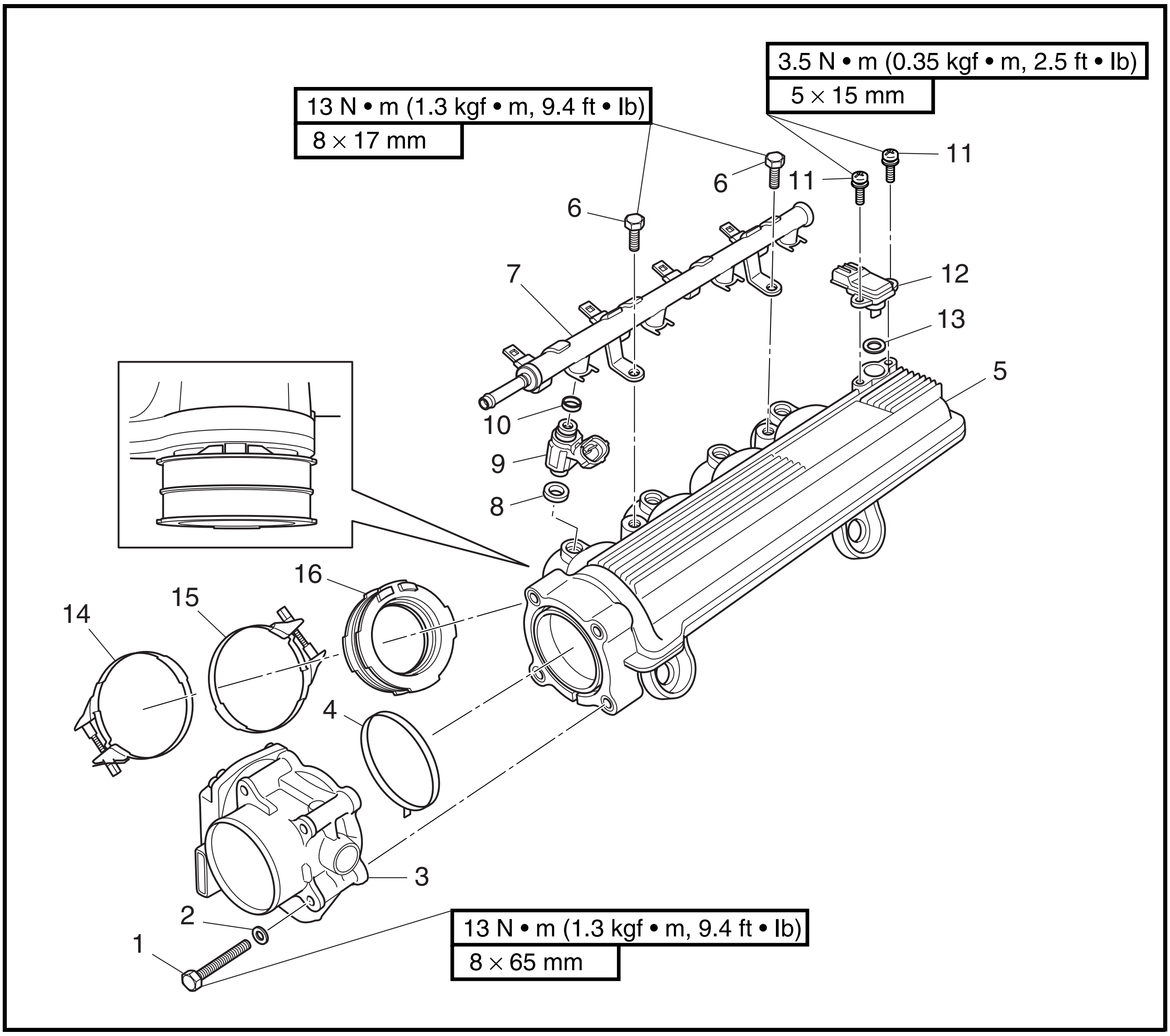
## EXPLODED DIAGRAM



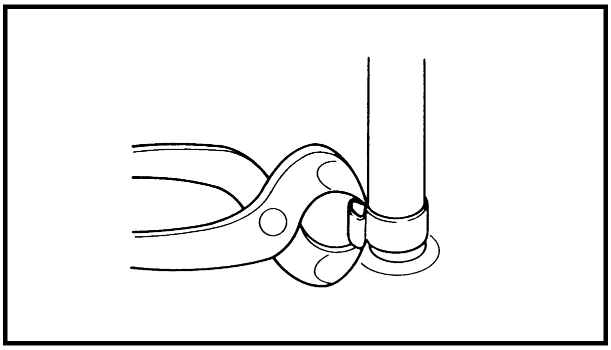

## REMOVAL AND INSTALLATION CHART

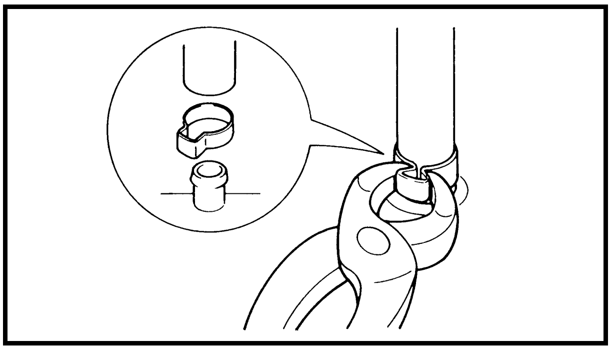
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **THROTTLE BODY ASSEMBLY AND INTAKE MANIFOLD DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Bolt | 4 | |
| 2 | Washer | 4 | |
| 3 | Throttle body assembly | 1 | |
| 4 | Gasket | 1 | **Not reusable** |
| 5 | Intake manifold | 1 | |
| 6 | Bolt | 2 | |
| 7 | Fuel rail | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Gasket | 4 | **Not reusable** |
| 9 | Fuel injector | 4 | |
| 10 | O-ring | 4 | **Not reusable** |
| 11 | Screw | 2 | |
| 12 | Sensor assembly | 1 | |
| 13 | O-ring | 1 | **Not reusable** |
| 14 | Clamp | 4 | |
| 15 | Clamp | 4 | |
| 16 | Intake manifold joint | 4 | |
| | | | Reverse the disassembly steps for assembly. |





## SERVICE POINTS

**Fuel hose clamps removal**

1. Remove:
   - Fuel hose clamps

**CAUTION:**

**If the fuel hose clamps are removed without cutting the joint first, the fuel hose will be damaged.**

**Hose clamps installation**

1. Install:
   - Fuel hose clamps

**⚠ WARNING**

**Do not reuse the fuel hose clamps, always replace them with new ones.**

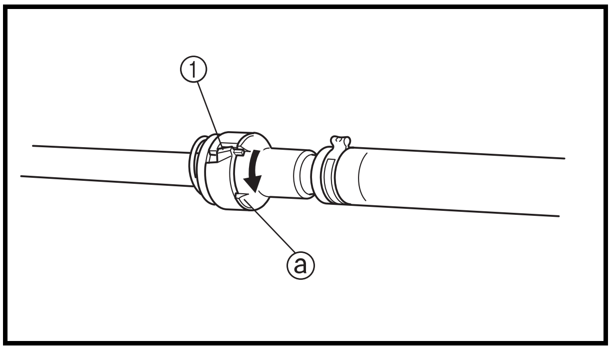
**NOTE:**

Crimp the fuel hose clamps properly to securely fasten them.

**Fuel hose disconnection**

**⚠ WARNING**

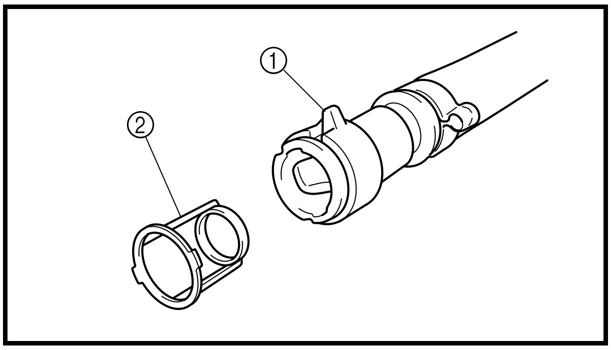
**Before disconnecting the hose, remove the fuel tank filler cap to reduce any pressure inside the fuel tank, and then disconnect the battery negative lead to cut off the electric current to the electrical systems.**




1. Wrap the quick connector with a cloth, and then rotate the quick connector tab ① to the stopper position ⓐ.

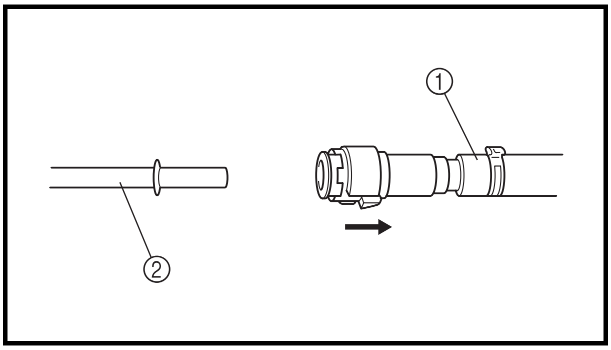
**⚠ WARNING**

**If the quick connector is removed suddenly, pressurized fuel could spray out. To gradually release the fuel pressure, be sure to remove the quick connector slowly.**




**CAUTION:**

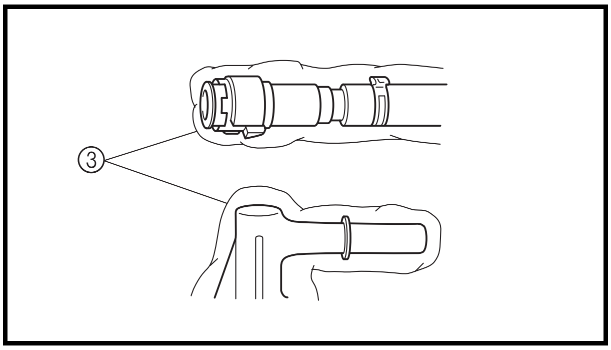
- **Do not rotate the quick connector tab ① past the stopper position, otherwise it could be damaged.**
- **When the fuel hoses are disconnected, quickly remove the retainer ② from the quick connector, otherwise the retainer could be lost.**




2. Disconnect the fuel hose ① from the fuel pipe ② directly.

**⚠ WARNING**

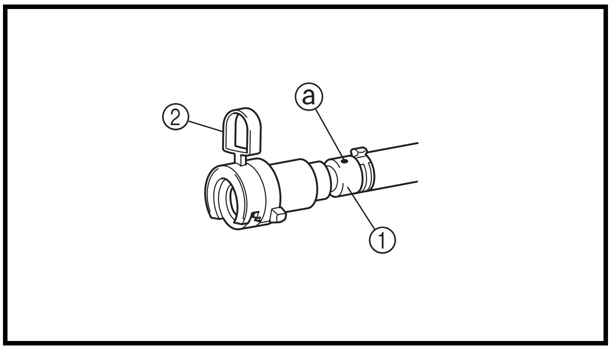
**Always reduce the fuel pressure in the fuel line before servicing the line or the fuel pipe. If the fuel pressure is not released, pressurized fuel could spray out.**

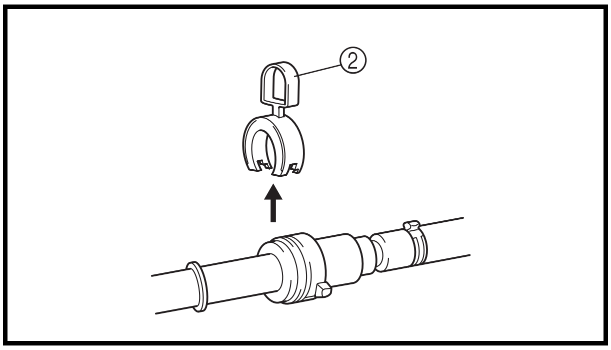



3. Cover the quick connector and fuel pipe with a plastic bag ③ to prevent damage and to protect them from dirt.

**Fuel line inspection**

1. Inspect:
   - Fuel hose
     Damage/cracks → Replace.
   - O-rings (quick connector)
     Damage/cracks → Replace the quick connector.
   - Fuel pipe
     Damage/cracks → Replace the fuel pump.




**Fuel hose installation (replacing with new fuel hose)**

1. Install:
   - Fuel hose ①

**NOTE:**

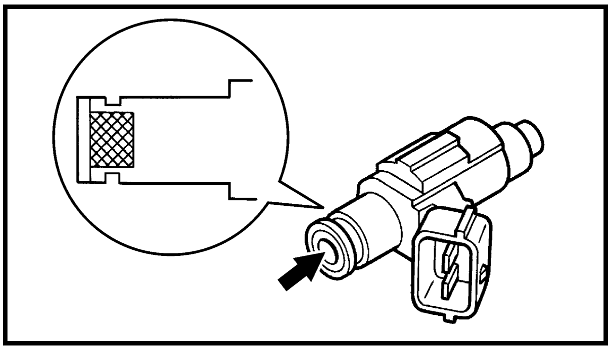
- To install the fuel hose, be sure to align the white mark ⓐ of the fuel hose with the checker tab ② of the quick connector.
- When replacing the fuel hose with a new one, a checker tab ② that has half engagement prevention is attached to the quick connector of the hose. If the quick connector is completely installed to the fuel pipe, it is removable.

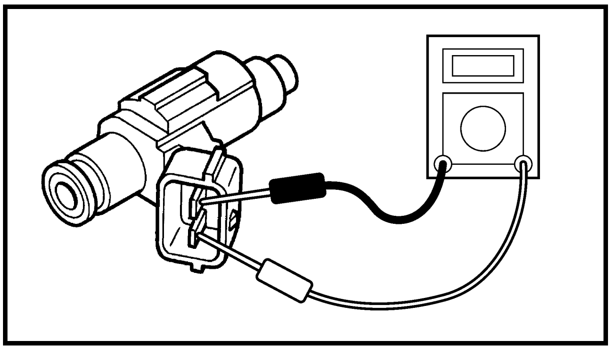
**Fuel hose connection**

1. Apply a thin coat of engine oil to the contact surfaces of the fuel pipe.
2. Insert the quick connector into the fuel pipe until you hear a “click.”
3. To check the connection of the quick connector, push and pull on the quick connector several times until there is free play of 2–3 mm (0.08–0.12 in).

**NOTE:**

If free is not obtained, disconnect the fuel hose and check the O-ring for damage and that it is properly installed.





**Fuel injectors inspection**

**NOTE:**
Do not remove the throttle body assembly.

1. Check:
   - Fuel injectors
     Dirt/residue → Clean.
     Damage → Replace.
2. Measure:
   - Fuel injectors resistance
     Out of specification → Replace.

**Digital multimeter:**
**YU-34899-A**
**Digital circuit tester:**
**90890-03174**

**Fuel injector resistance:**
**(reference data)**
**11.5–12.5 Ω at 20 °C (68 °F)**

3. Check the operation of the fuel injector using the "Stationary Test" of the Yamaha Diagnostic System.

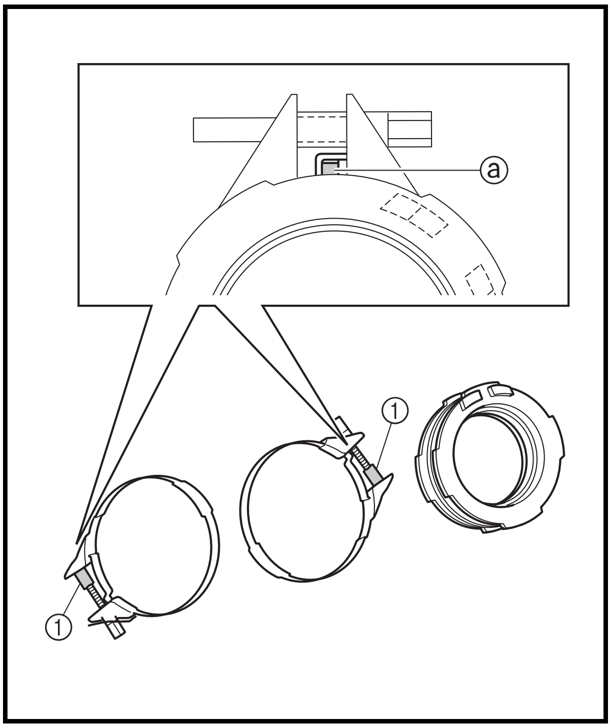
**Throttle body assembly inspection**

**CAUTION:**

**The throttle body assembly should not be disassembled.**

1. Check:
   - Throttle body assembly
     Cracks/damage → Replace the throttle body assembly.

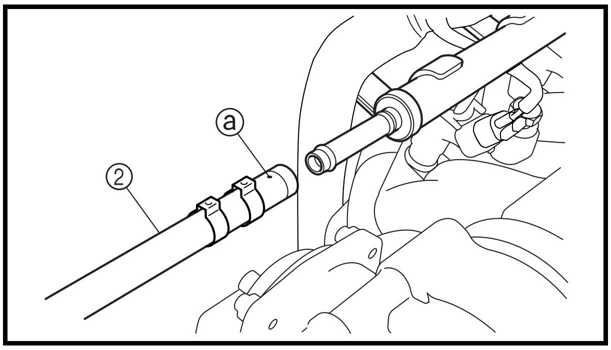
**Accelerator position sensor inspection**
1. Inspect:
   - Accelerator position sensor
     Damage/cracks → Replace the accelerator position sensor.

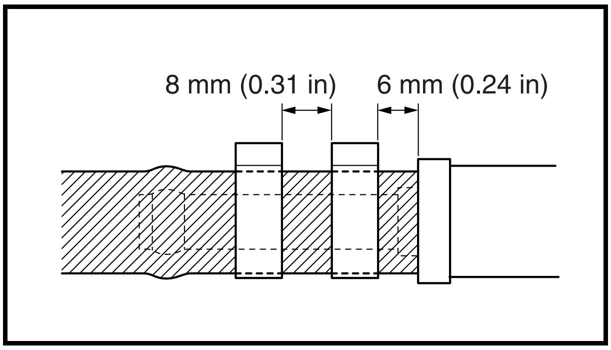



**Intake assembly installation**

1. Install:
   - Intake screw clamp
   - Intake manifold joint
   - Intake assembly

**NOTE:**
- Install the intake screw clamp in the direction shown in the illustration, making sure to align the indentation in the clamp with the projection ⓐ on the intake manifold joint.
- Tighten the clamp screw until both ends of the intake screw clamp contact the spacer ① around the screw.



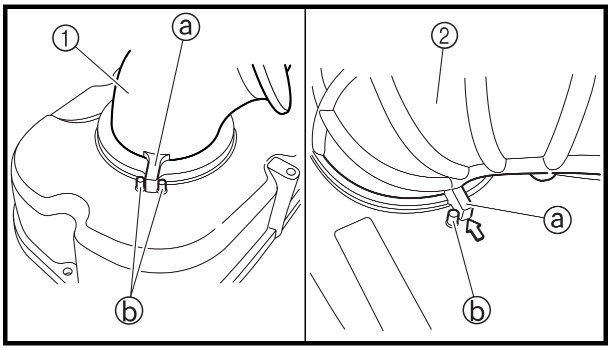




2. Install:
   - Fuel hose ② (fuel rail side)
   - Fuel hose clamps

**⚠ WARNING**

**Do not reuse the fuel hose clamps, always replace them with new ones.**

**NOTE:**
- Install the fuel hose with the white mark ⓐ facing up.
- Install the fuel hose clamps at the locations shown in the illustration, and then crimp them to securely fasten them.

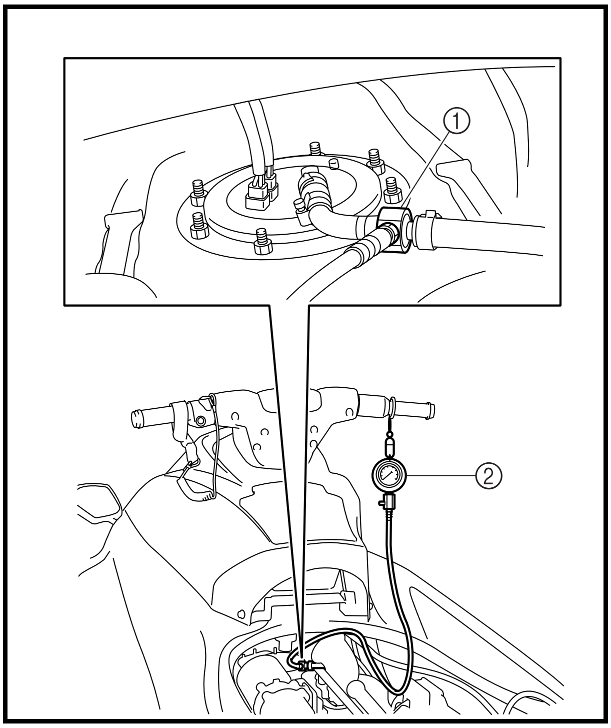



**Air filter case assembly installation**

1. Install:
   - Air intake duct ①
   - Air intake hose ②
   - Air filter case cover

**NOTE:**
Align the projections ⓐ on the air intake duct and air intake hose with the projections ⓑ on the air filter case cover as shown in the illustration.

2. Adjust:
   - Throttle lever free play
     Refer to “CONTROL SYSTEM” in Chapter 3.




**Fuel pressure measurement**

1. Disconnect:
   - Fuel hose
     Refer to “Fuel hose disconnection”.
2. Install:
   - Fuel pressure gauge adapter ①
   - Fuel pressure gauge ②

**Fuel pressure gauge adapter:**
**YW-06842/90890-06842**
**Fuel pressure gauge:**
**YB-06766/90890-06786**

**NOTE:**
To connect the fuel pressure gauge adapter, follow the procedures for connecting a fuel hose. (Refer to “Fuel hose connection”.)

3. Start the engine and arrow it to warm up for several minutes.
4. Measure:
   - Fuel pressure
     Out of specification → Replace the fuel pump module.

**Fuel pressure:**
**320–327 kPa**
**(3.2–3.3 kgf/cm$^2$, 46–47 psi)**

5. Remove:
   - Fuel pressure gauge
   - Fuel pressure gauge adapter

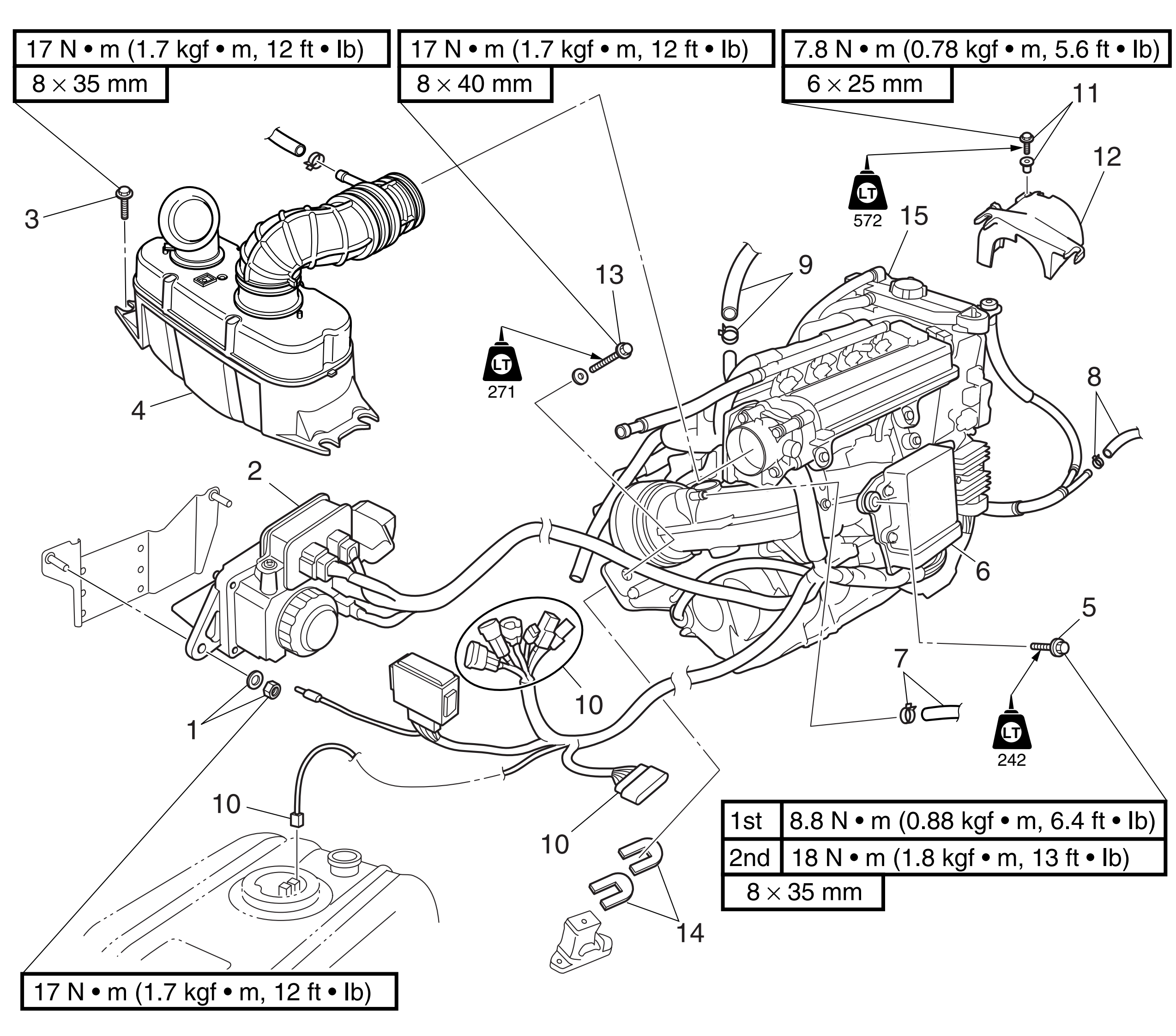
**NOTE:**
To disconnect the fuel pressure gauge adapter, follow the procedures for disconnecting a fuel hose. (Refer to “Fuel hose disconnection”.)

6. Connect:
   - Fuel hose
     Refer to “Fuel hose connection”.

# CHAPTER 5
# POWER UNIT

# ENGINE UNIT

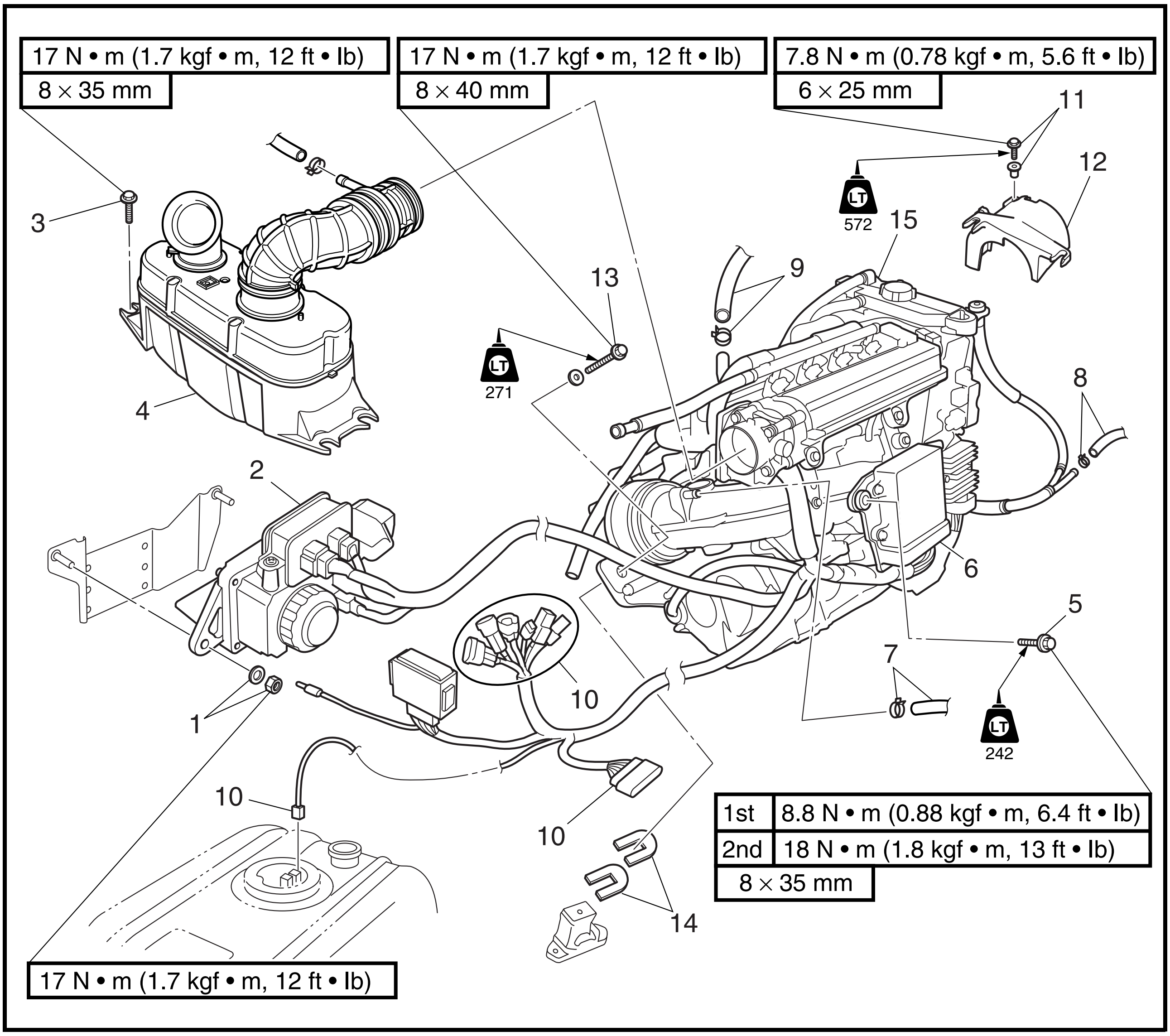
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

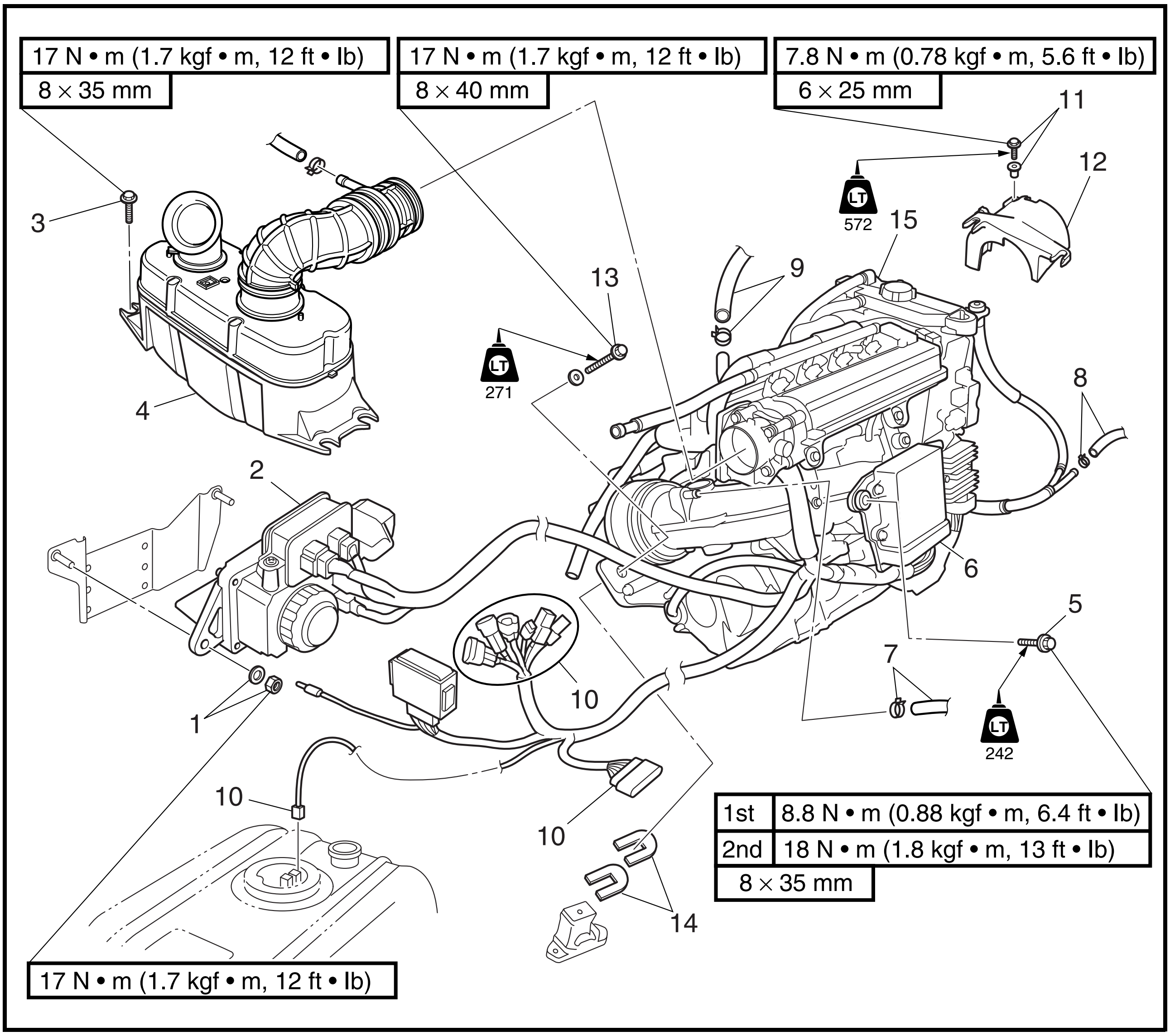
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **ENGINE UNIT REMOVAL** | | Follow the left "Step" for removal. |
| | Engine oil | | Drain.<br>Refer to "POWER UNIT" in Chapter 3. |
| | Storage compartment panel | | Refer to "FRONT HOOD" in Chapter 8. |
| | Battery negative and positive lead | | Refer to "FUSE BOX" in Chapter 7. |
| | Fuel hose | | Refer to "FUEL INJECTION SYSTEM" in Chapter 4. |
| | Water lock and exhaust joint | | Refer to "EXHAUST SYSTEM" in Chapter 8. |
| 1 | Bolt/washer | 2/2 | |
| 2 | Fuse box | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 3 | Bolt | 2 | |
| 4 | Air filter case assembly | 1 | |
| 5 | Bolt | 1 | |
| 6 | ECM and rectifier/regulator assembly | 1 | |
| 7 | Clamp/cooling water hose | 1/1 | Cooling water pilot outlet |
| 8 | Clamp/cooling water hose | 1/1 | Cooling water inlet |
| 9 | Clamp/cooling water hose | 1/1 | Cooling water outlet |
| 10 | Coupler | 10 | |
| 11 | Bolt/collar | 1/1 | |
| 12 | Coupling cover | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 13 | Bolt/washer | 4/4 | |
| 14 | Shim | * | |
| 15 | Engine unit | 1 | |
| | | | Reverse the removal steps for installation. |

*: As required.

## SERVICE POINTS

### Compression pressure measurement

The following procedure applies to all of the cylinders.

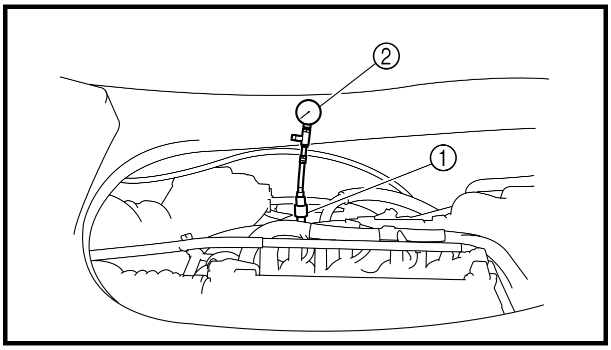
**NOTE:**

Insufficient compression pressure will result in a loss of performance.

1. Measure:
   - Valve clearance
     Out of specification → Adjust.
     Refer to “POWER UNIT” in Chapter 3.
2. Warm the engine up, and then put the watercraft in a horizontal position.
3. Remove:
   - Ignition coils
   - Spark plugs

**CAUTION:**

**Before removing the spark plugs, use compressed air to blow away any dirt accumulated in the spark plug wells to prevent it from falling into the cylinders.**




4. Install:
   - Compression gauge extension ①
   - Compression gauge ②

**Compression gauge extension:**
**90890-06582**
**Compression gauge:**
**YU-33223-1/90890-03160**

5. Measure:
   - Compression pressure
     Out of specification → Refer to steps (b) and (c).

**Minimum compression pressure (reference data):**
**1,150 kPa**
**(11.5 kgf/cm², 164 psi)**

**Measurement steps:**

a. With the throttle wide open, crank the engine until the reading on the compression gauge stabilizes.

**NOTE:**

The difference in compression pressure between cylinders should not exceed 100 kPa (1 kgf/cm², 14 psi).

b. If the compression pressure is extremely high, check the cylinder head, valve surfaces and piston crown for carbon deposits.
   Carbon deposits → Eliminate.

c. If the compression pressure is below the minimum specification, squirt a few drops of oil into the cylinder and measure again.

Refer to the following table.

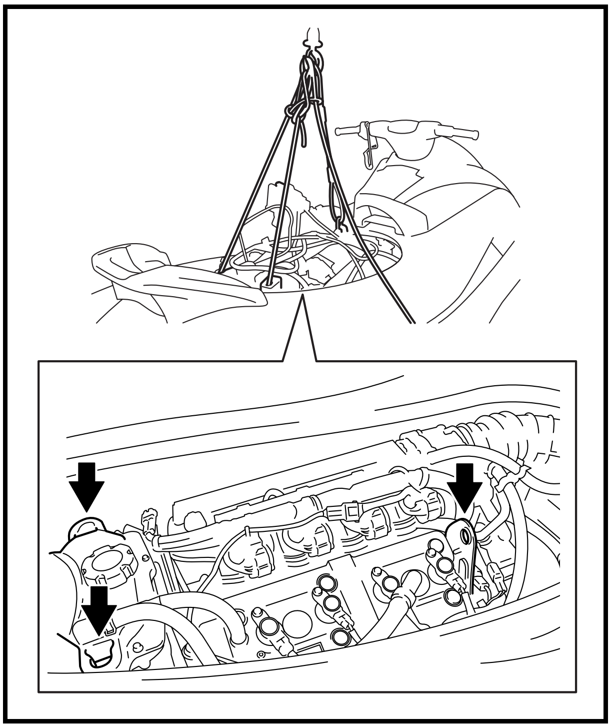
| Compression pressure (with oil applied into the cylinder) | |
|---|---|
| **Reading** | **Diagnosis** |
| **Higher than without oil** | **Piston ring wear, piston wear or damage → Repair.** |
| **Same as without oil** | **Valves, cylinder head gasket or piston possibly defective → Repair.** |

6. Install:
   - Spark plug

**Spark plug:**
**13 N • m (1.3 kgf • m, 9.4 ft • lb)**

7. Install:
   - Ignition coils

| Ignition coils bolt: |
| --- |
| 7.6 N • m (0.76 kgf • m, 5.5 ft • lb) |
| LOCTITE 572 |



**Engine unit removal**

1. Remove:
   - Engine unit

**Removal steps:**

**CAUTION:**

**Lift the engine unit carefully trying not to hit it on the deck or letting it fall hard on the hull.**

- Suspend the engine unit using all three engine hangers, and then separate the unit from the engine mount.

**Shim removal**

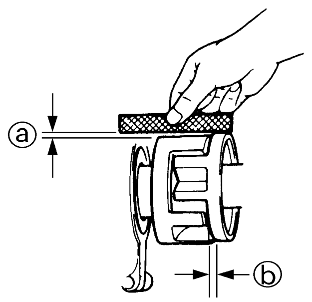
1. Remove:
   - Shims

**NOTE:**

To ease reassembly and coupling alignment, remove the shims and organize them in their respective groups (e.g., front right, rear left) prior to removing the mounting bolts.

**Engine mount inspection**

1. Inspect:
   - Engine mounts
     Cracks/damage → Replace.
     Refer to “ENGINE MOUNT” in Chapter 8.

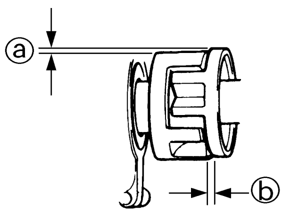



### Coupling clearance inspection

1. Measure:
   - Clearance ⓐ
   - Clearance ⓑ
     Out of specification → Adjust.

**NOTE:**
Measure the clearances with a straightedge and thickness gauge.

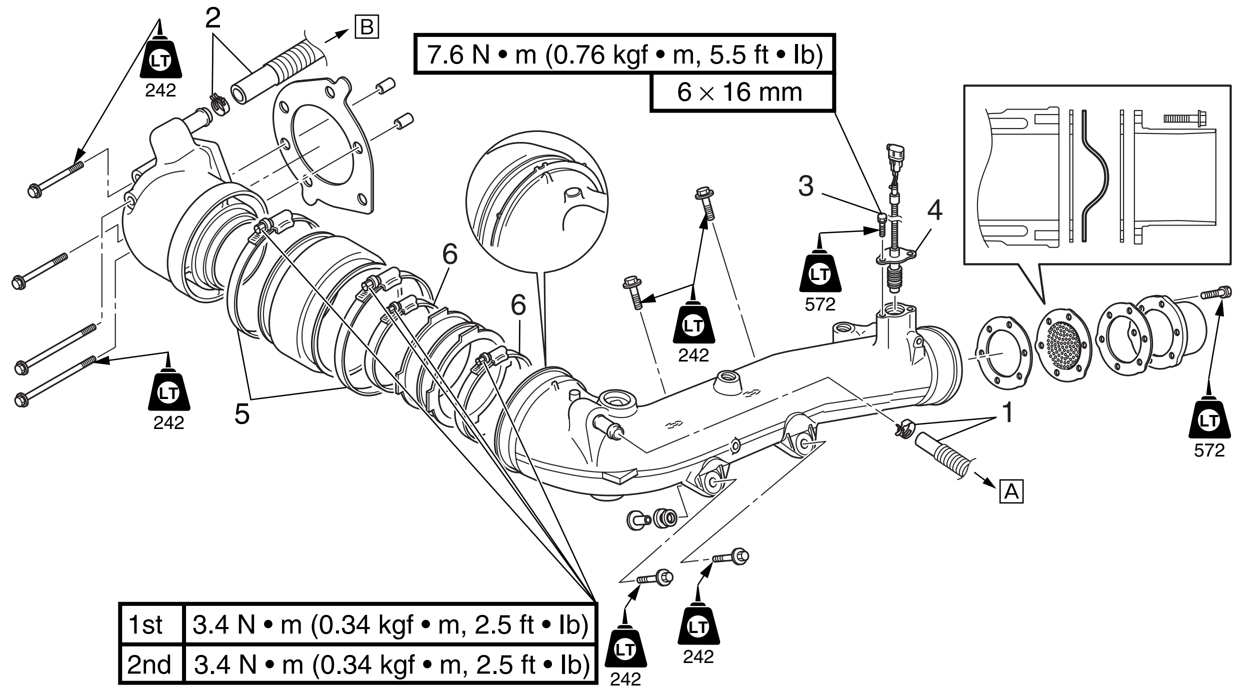
**Clearance ⓐ:**
**0–0.5 mm (0–0.020 in)**
**Clearance ⓑ:**
**2–4 mm (0.079–0.157 in)**




2. Adjust:
   - Clearance ⓐ and ⓑ

**Adjustment steps:**
- Adjust the clearance ⓐ by adding or removing shims.
- Adjust the clearance ⓑ by moving the engine unit position.

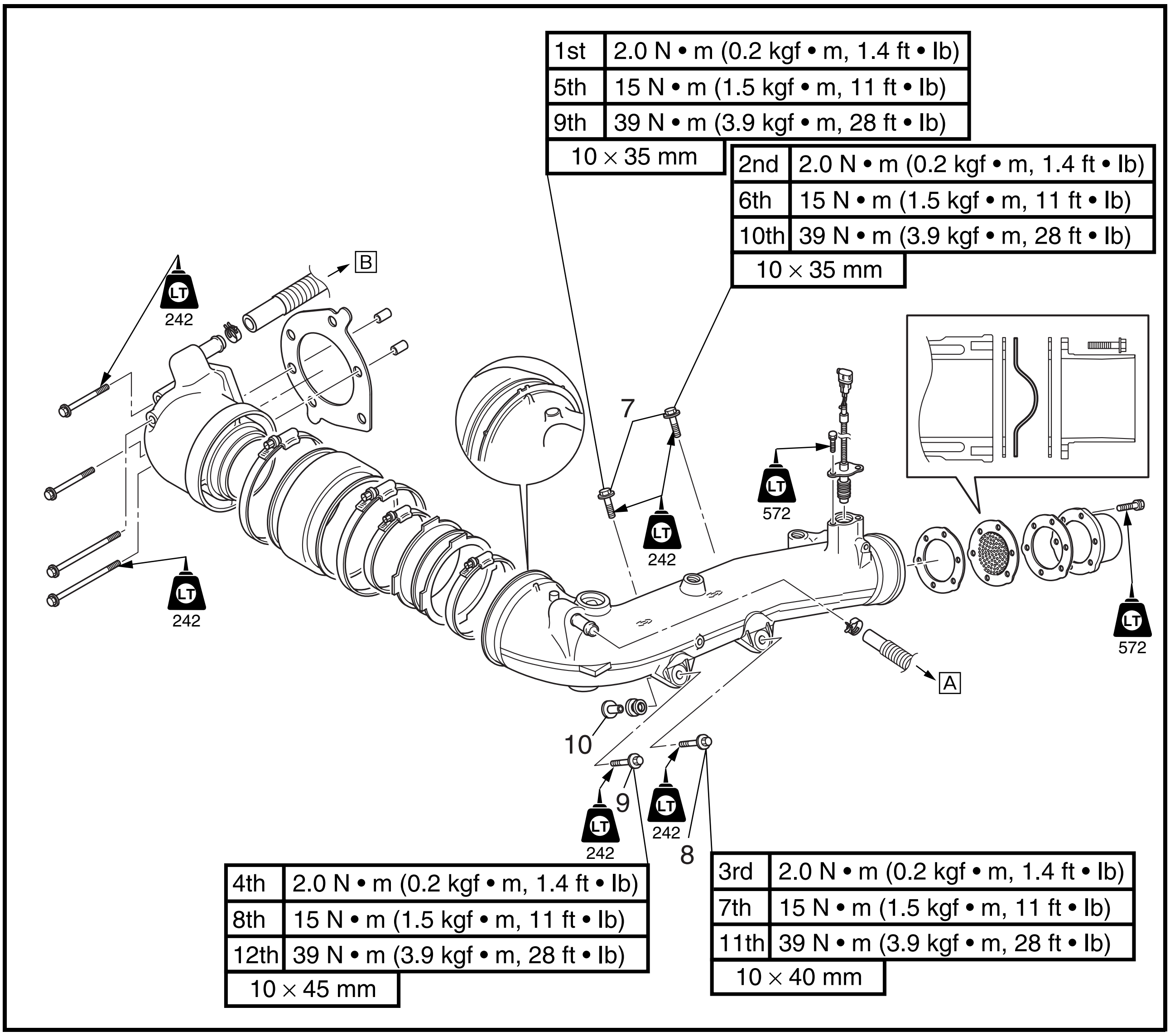
# EXHAUST PIPES 1 AND 2
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

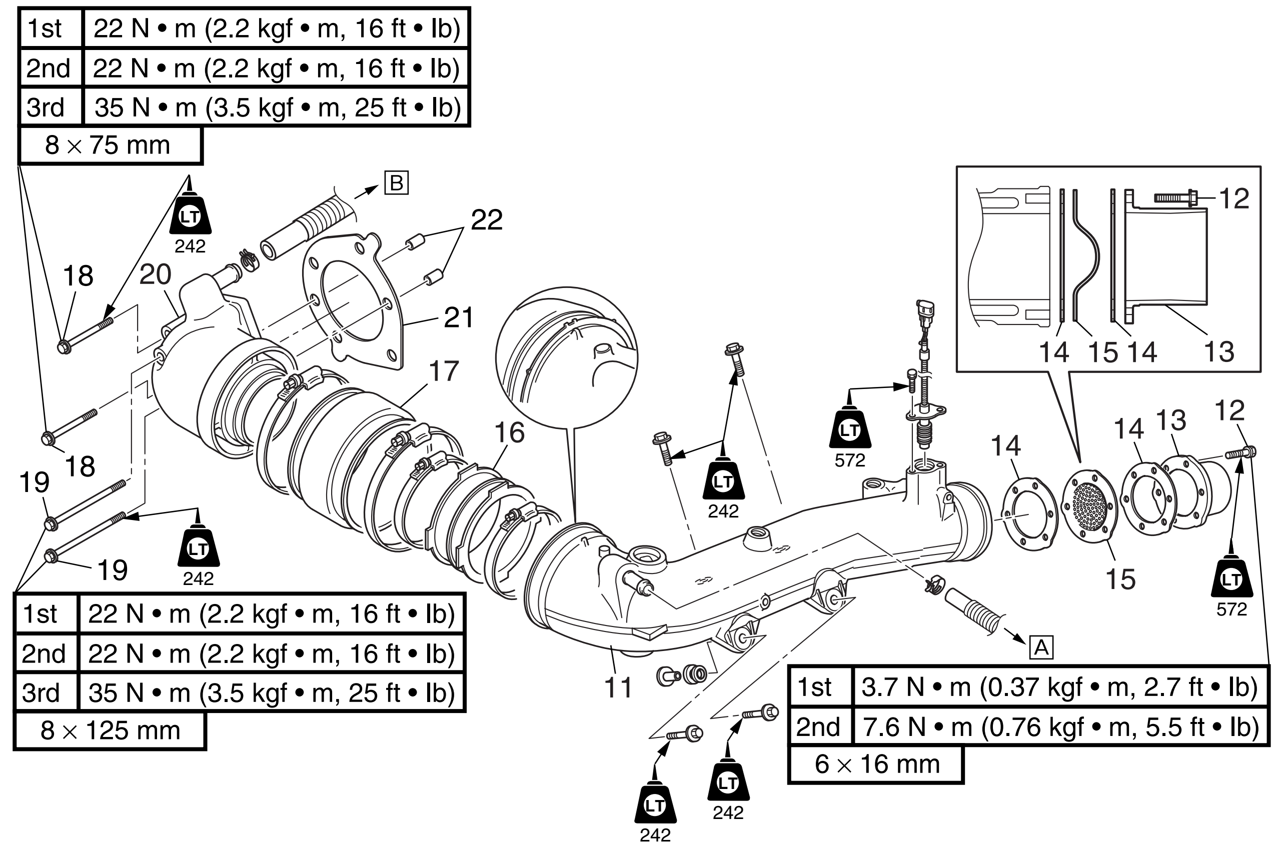
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **EXHAUST PIPES 1 AND 2 REMOVAL** | | Follow the left "Step" for removal. |
| | Engine unit | | Refer to "ENGINE UNIT".<br>A For cooling water pilot outlet on port side<br>B From water jacket |
| 1 | Clamp/cooling water hose | 1/1 | |
| 2 | Clamp/cooling water hose | 1/1 | |
| 3 | Bolt | 2 | |
| 4 | Thermoswitch (exhaust) | 1 | |
| 5 | Exhaust joint clamp | 2 | Slide the outer exhaust joint for exhaust manifold side |
| 6 | Exhaust joint clamp | 2 | |

## EXPLODED DIAGRAM



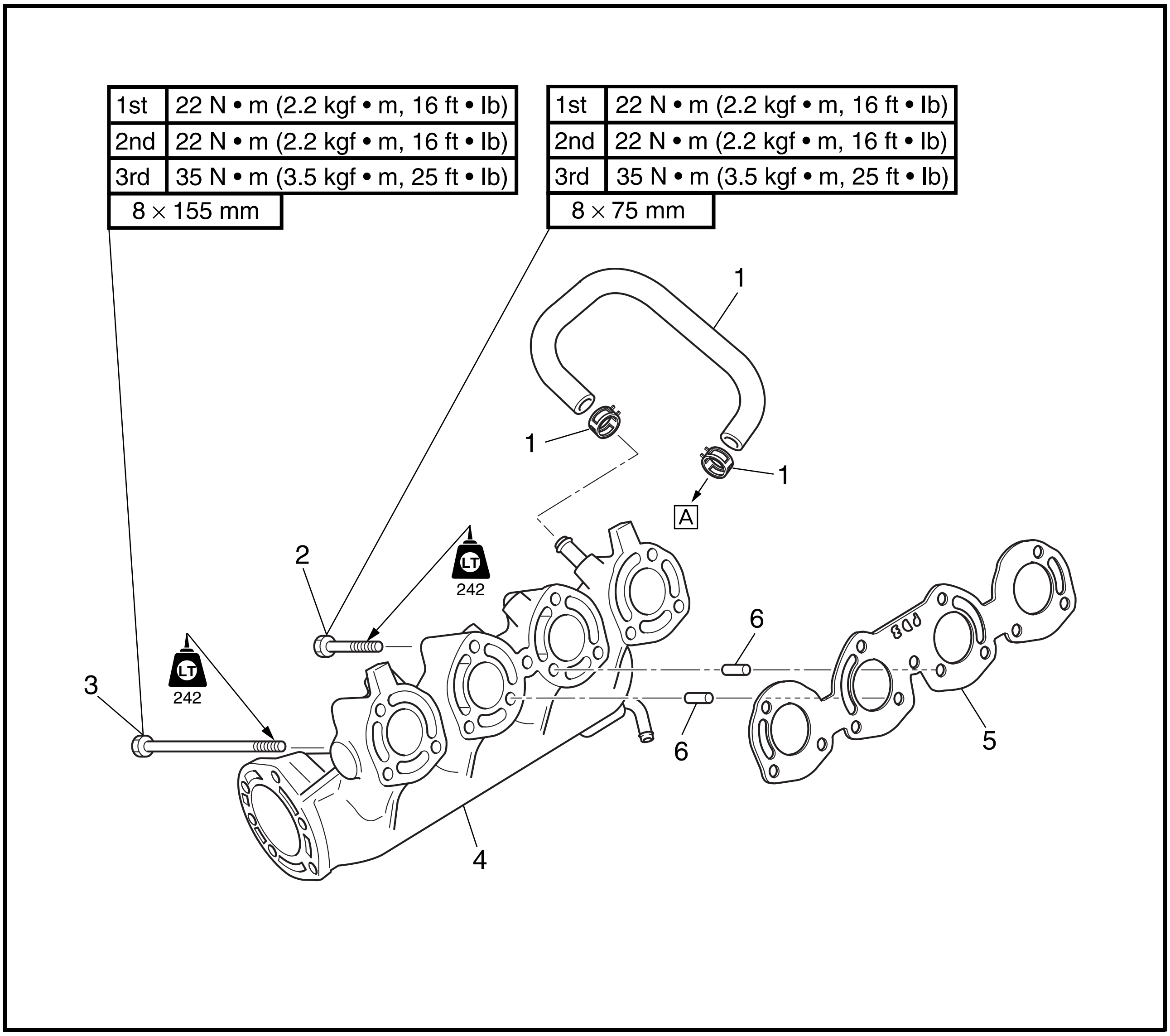

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 7 | Bolt | 1 | **NOTE:** |
| 8 | Bolt | 1 | Tighten the bolts in the sequence indicated. |
| 9 | Bolt | 2 | |
| 10 | Collar | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 11 | Exhaust pipe 2 | 1 | |
| 12 | Bolt | 3 | |
| 13 | Exhaust pipe end | 1 | |
| 14 | Gasket | 2 | **Not reusable** |
| 15 | Silencer | 1 | |
| 16 | Inner exhaust joint | 1 | |
| 17 | Outer exhaust joint | 1 | |
| 18 | Bolt | 2 | |
| 19 | Bolt | 2 | |
| 20 | Exhaust pipe 1 | 1 | |
| 21 | Gasket | 1 | **Not reusable** |
| 22 | Dowel pin | 2 | |
| | | | Reverse the removal steps for installation. |

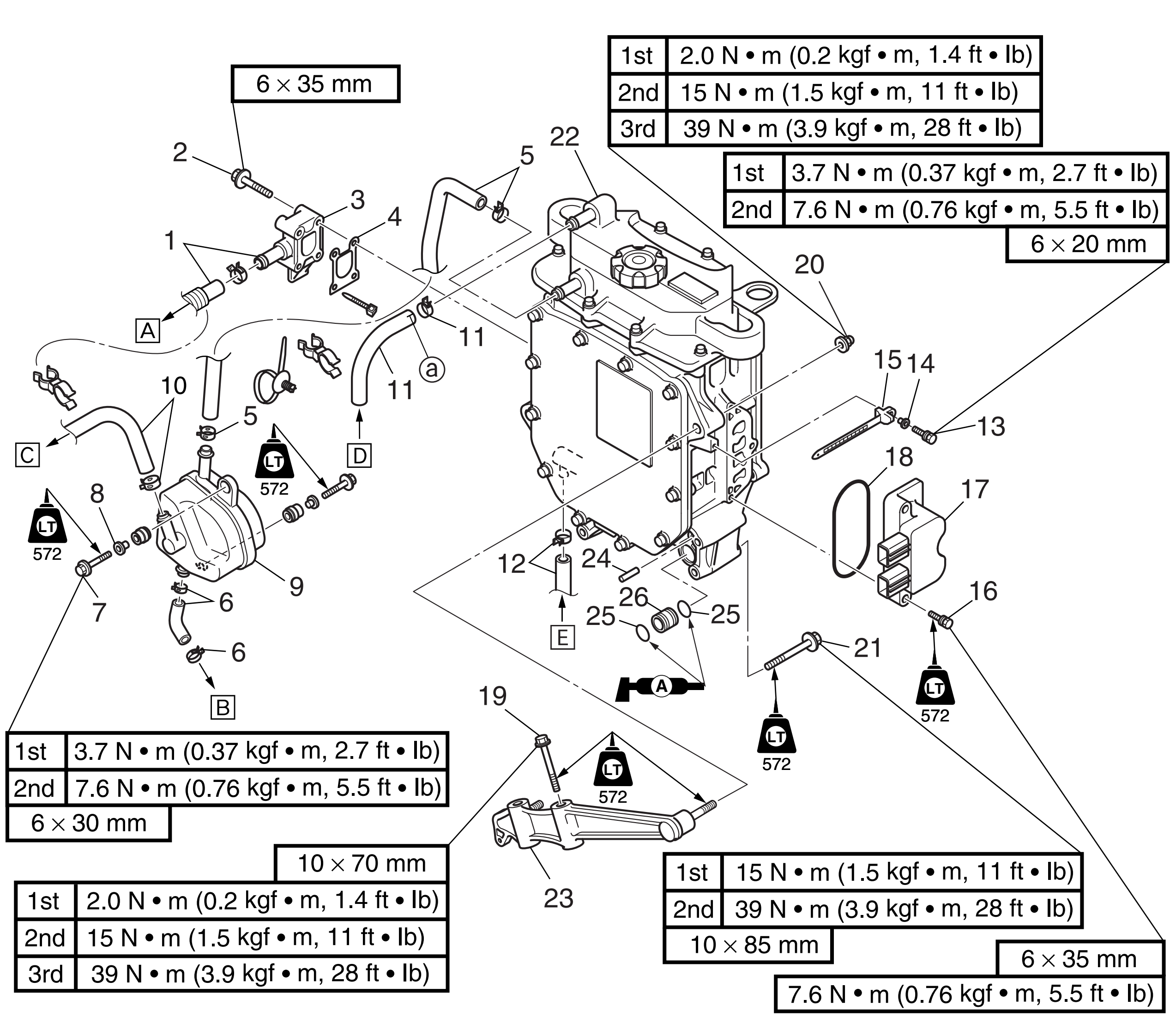
# EXHAUST MANIFOLD
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **EXHAUST MANIFOLD REMOVAL** | | Follow the left "Step" for removal. |
| | Exhaust pipes 1 and 2 | | Refer to "EXHAUST PIPES 1 AND 2". |
| 1 | Clamp/cooling hose | 2/1 | A To cylinder block |
| 2 | Bolt | 5 | |
| 3 | Bolt | 6 | |
| 4 | Exhaust manifold | 1 | |
| 5 | Gasket | 1 | **Not reusable** |
| 6 | Dowel pin | 2 | |
| | | | Reverse the removal steps for installation. |

# OIL TANK
## EXPLODED DIAGRAM



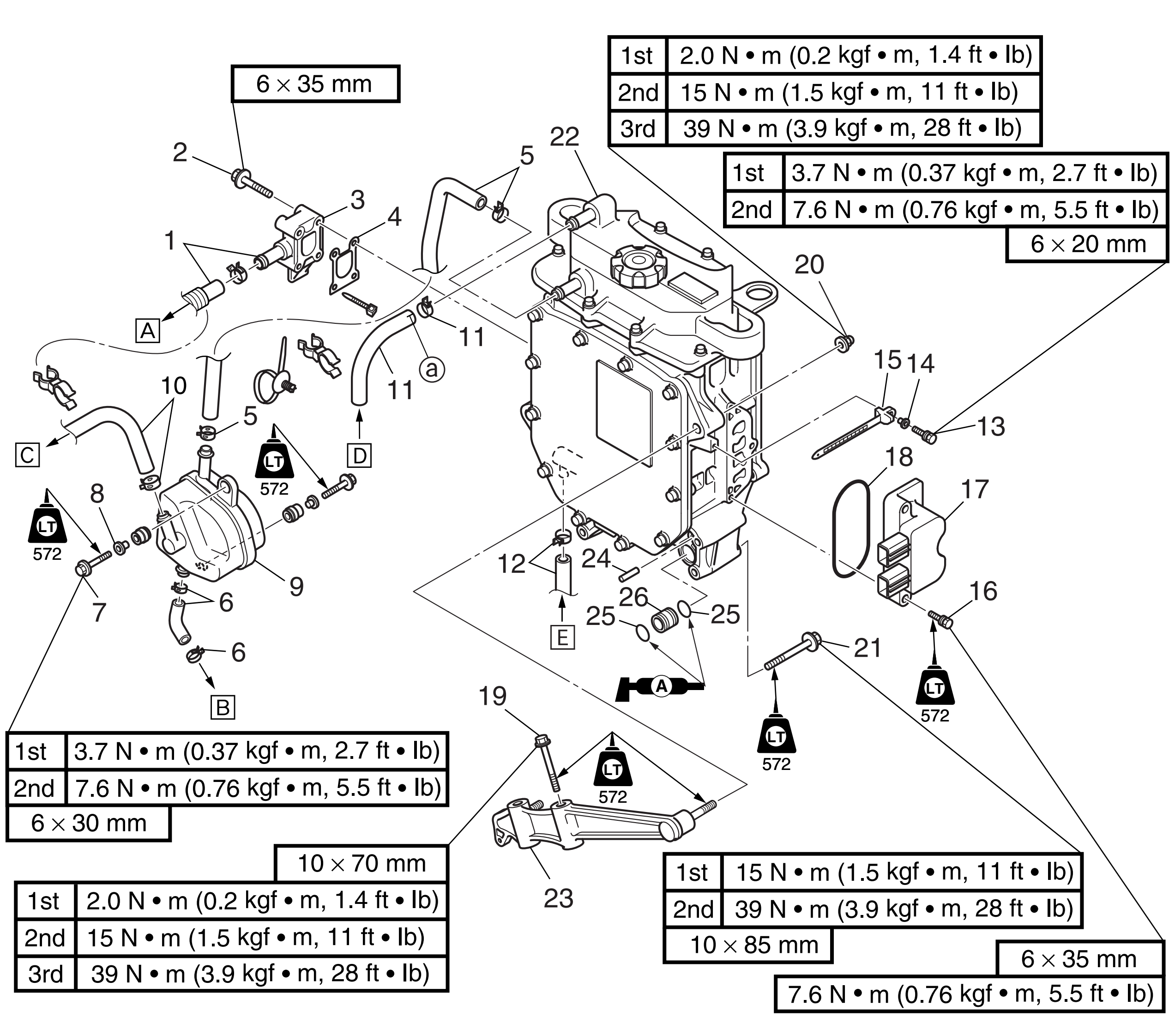

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **OIL TANK REMOVAL** | | Follow the left "Step" for removal. |
| | Engine unit | | Refer to "ENGINE UNIT". |
| | Intake assembly | | Refer to "FUEL INJECTION SYSTEM" in Chapter 4. |
| 1 | Clamp/cooling water hose | 1/1 | A To exhaust pipe 1 |
| 2 | Bolt | 4 | |
| 3 | Water jacket | 1 | |
| 4 | Gasket | 1 | **Not reusable** |
| 5 | Clamp/breather hose | 2/1 | |
| 6 | Clamp/breather hose | 2/1 | B To oil pump |
| 7 | Bolt | 2 | |
| 8 | Collar | 2 | |

# OIL TANK

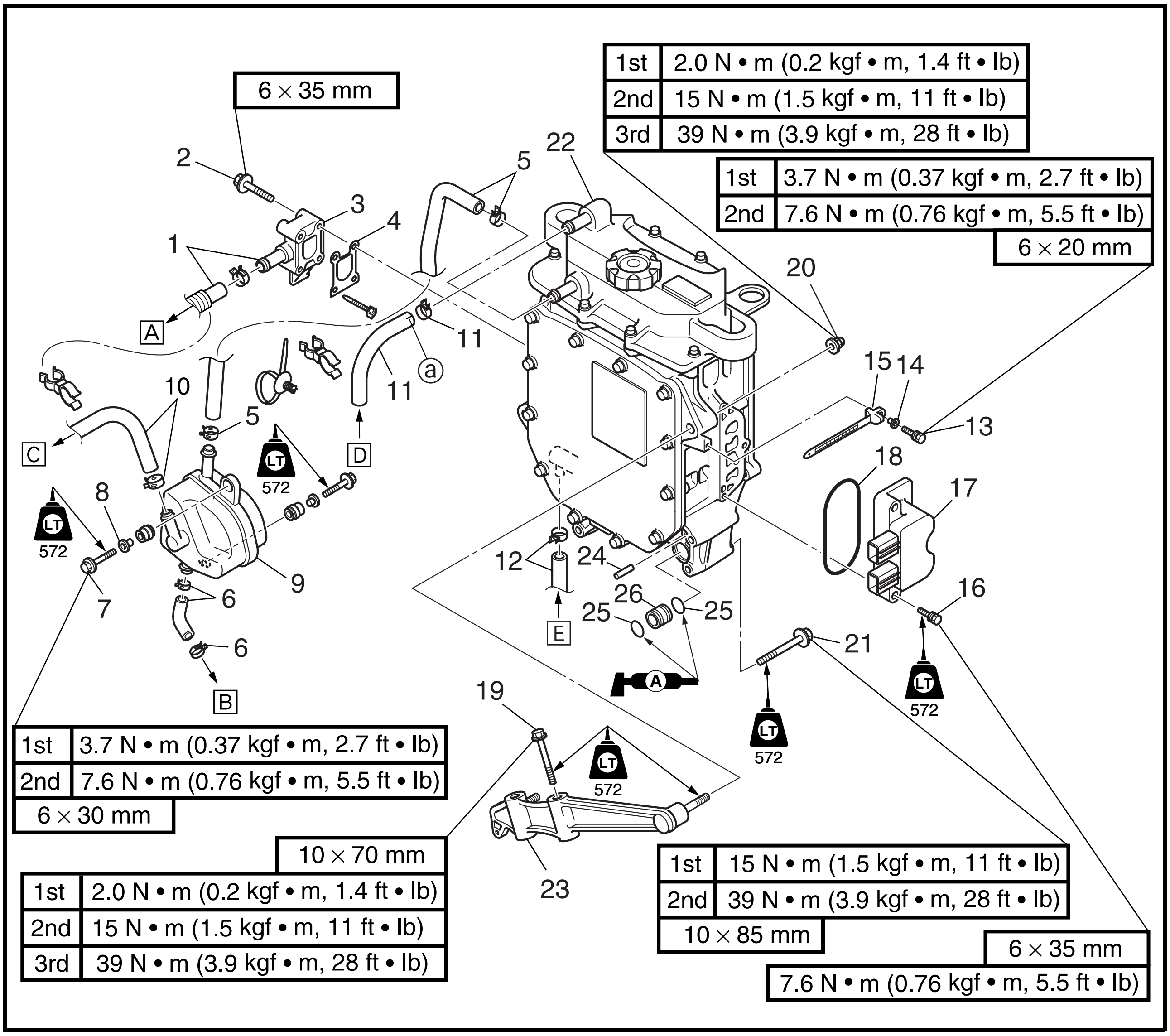


## EXPLODED DIAGRAM



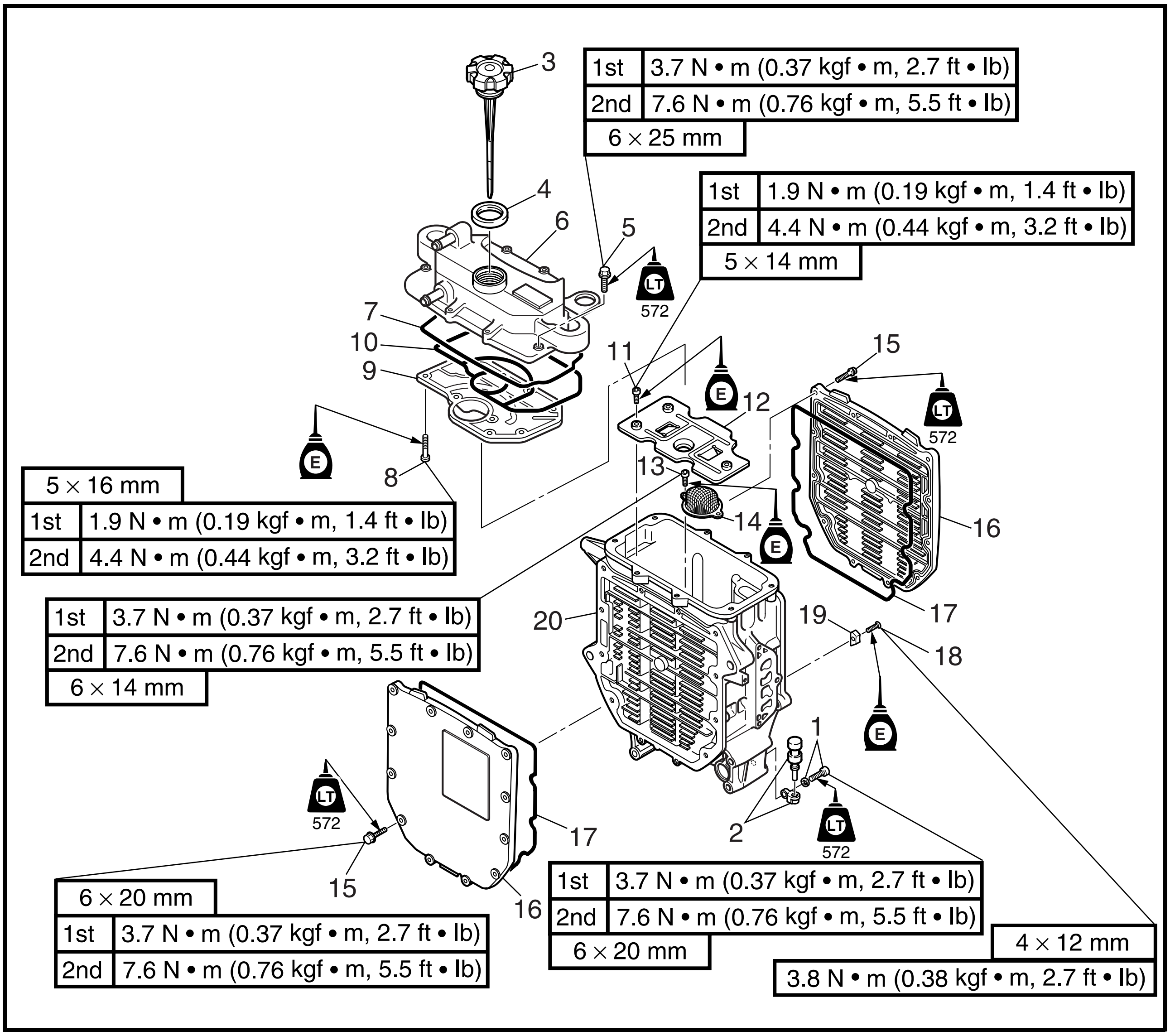

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 9 | Oil separator | 1 | |
| 10 | Clamp/breather hose | 1/1 | C To air intake pipe |
| 11 | Clamp/breather hose | 1/1 | D From cylinder head cover<br>Mark ⓐ |
| 12 | Clamp/cooling water hose | 1/1 | E From cooling water inlet |
| 13 | Bolt | 1 | |
| 14 | Collar | 1 | |
| 15 | Band | 1 | |
| 16 | Bolt | 3 | |
| 17 | Ground lead box | 1 | |
| 18 | O-ring | 1 | **Not reusable** |
| 19 | Bolt | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 20 | Nut | 2 | |
| 21 | Bolt | 5 | |
| 22 | Oil tank | 1 | |
| 23 | Oil tank stay | 1 | |
| 24 | Pin | 2 | |
| 25 | O-ring | 4 | **Not reusable** |
| 26 | Connector | 2 | |
| | | | Reverse the removal steps for installation. |

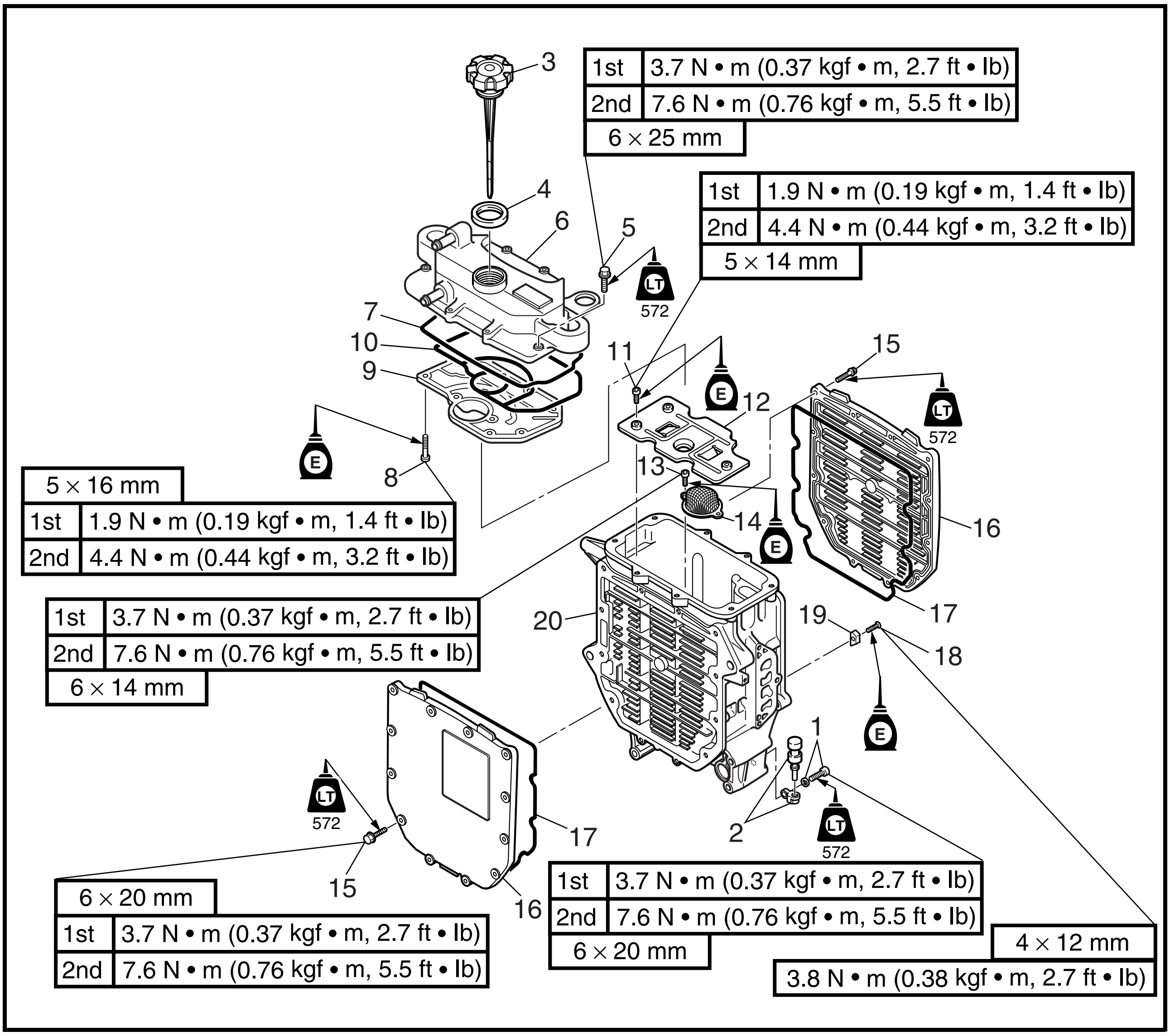
## EXPLODED DIAGRAM



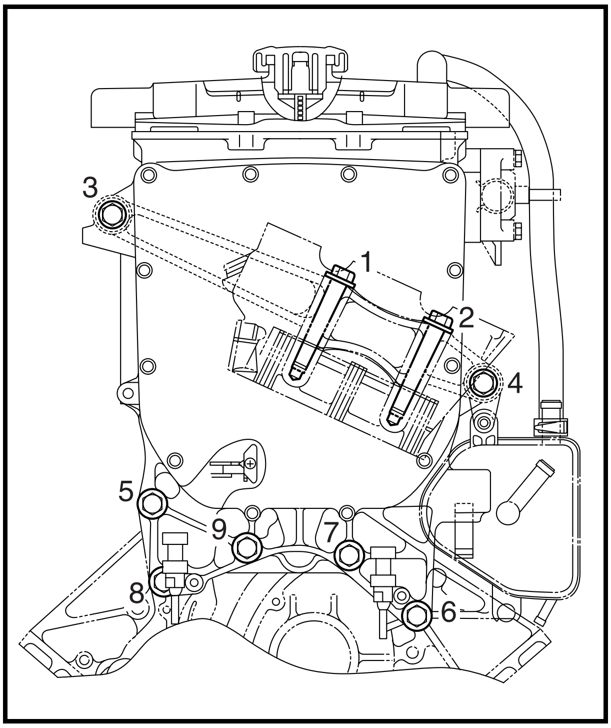

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **OIL TANK DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Bolt/washer | 2/2 | |
| 2 | Bracket/grommet | 2/2 | |
| 3 | Oil tank filler cap | 1 | |
| 4 | Packing | 1 | |
| 5 | Bolt | 8 | |
| 6 | Oil tank cover | 1 | |
| 7 | Gasket | 1 | **Not reusable** |
| 8 | Bolt | 9 | |
| 9 | Oil breather plate | 1 | |
| 10 | Gasket | 1 | **Not reusable** |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 11 | Bolt | 3 | |
| 12 | Baffle plate | 1 | |
| 13 | Bolt | 2 | |
| 14 | Oil strainer | 1 | |
| 15 | Bolt | 24 | |
| 16 | Oil cooler cover | 2 | |
| 17 | Gasket | 2 | **Not reusable** |
| 18 | Screw | 1 | |
| 19 | Anode | 1 | |
| 20 | Oil tank | 1 | |
| | | | Reverse the disassembly steps for assembly. |

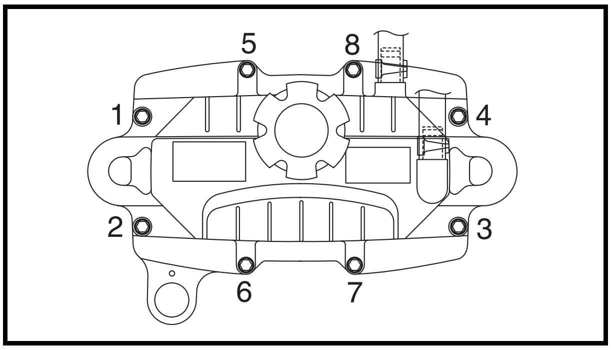



## SERVICE POINTS

### Oil tank removal

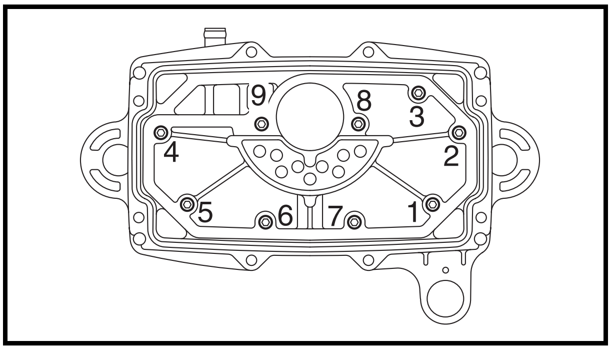
1. Remove:
   - Oil tank

**NOTE:**
Loosen the oil tank bolts and nuts in the sequence shown.



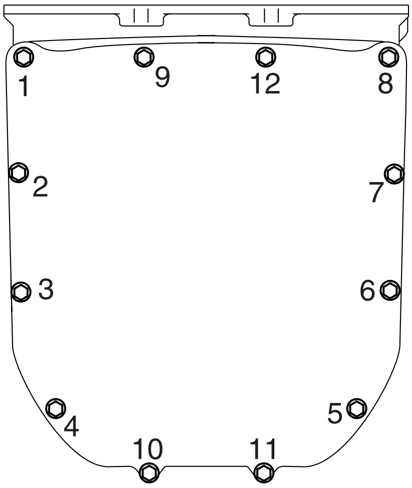

2. Remove:
   - Oil tank cover
   - Gasket

**NOTE:**
Loosen the oil tank cover bolts in the sequence shown.



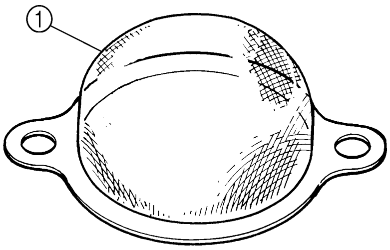

3. Remove:
   - Oil breather plate
   - Gasket

**NOTE:**
Loosen the oil breather plate bolts in the sequence shown.



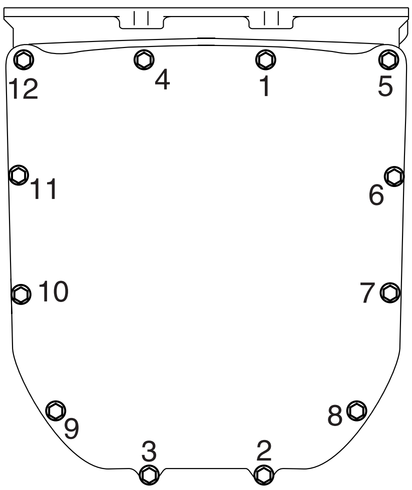

4. Remove:
   - Oil cooler covers
   - Gaskets

**NOTE:**
Loosen the oil cooler cover bolts in the sequence shown.




**Oil strainer inspection**

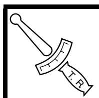
1. Check:
   - Oil strainer ①
     Damage → Replace.
     Contaminants → Clean.



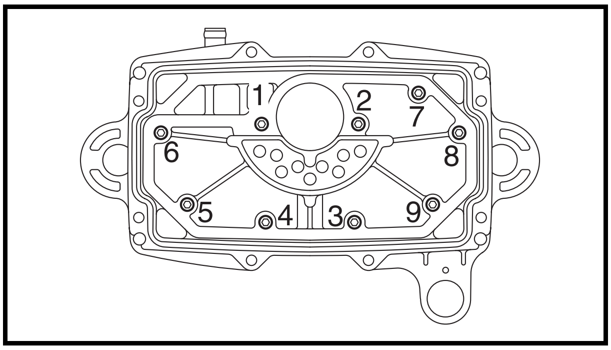

**Oil tank installation**

1. Install:
   - Gaskets
   - Oil cooler covers

**NOTE:**
Tighten the oil cooler bolts in the sequence shown.



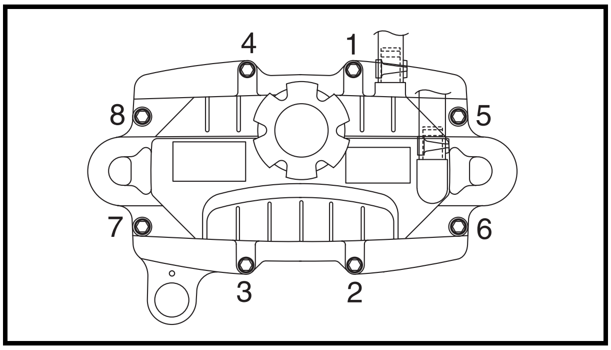
**Oil cooler cover bolt:**
**1st:**
**3.7 N • m**
**(0.37 kgf • m, 2.7 ft • lb)**
**2nd:**
**7.6 N • m**
**(0.76 kgf • m, 5.5 ft • lb)**
**LOCTITE 572**




2. Install:
   - Gasket
   - Oil breather plate

**NOTE:**
Tighten the oil breather plate bolts in the sequence shown.

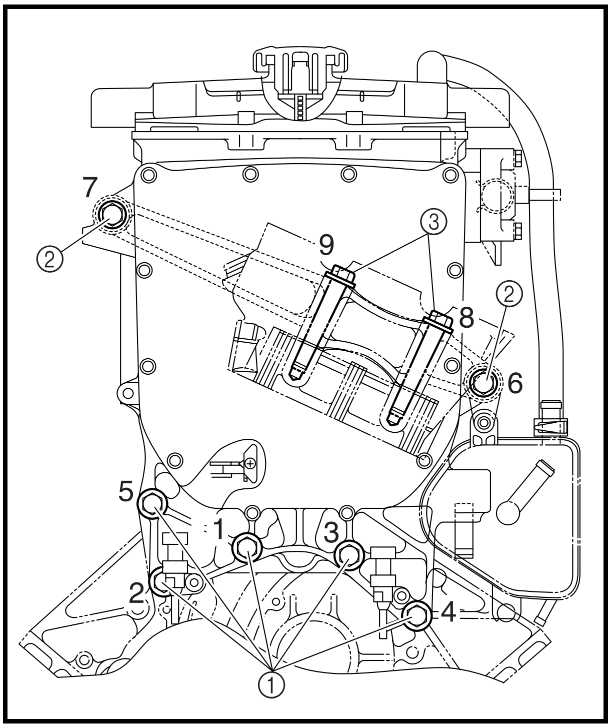
**Oil breather plate bolt:**
**1st:**
**1.9 N • m**
**(0.19 kgf • m, 1.4 ft • lb)**
**2nd:**
**4.4 N • m**
**(0.44 kgf • m, 3.2 ft • lb)**




3. Install:
   - Gasket
   - Oil tank cover

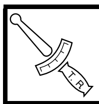
**NOTE:**
Tighten the oil tank cover bolts in the sequence shown.

**Oil tank cover bolt:**
**1st:**
**3.7 N • m**
**(0.37 kgf • m, 2.7 ft • lb)**
**2nd:**
**7.6 N • m**
**(0.76 kgf • m, 5.5 ft • lb)**
**LOCTITE 572**



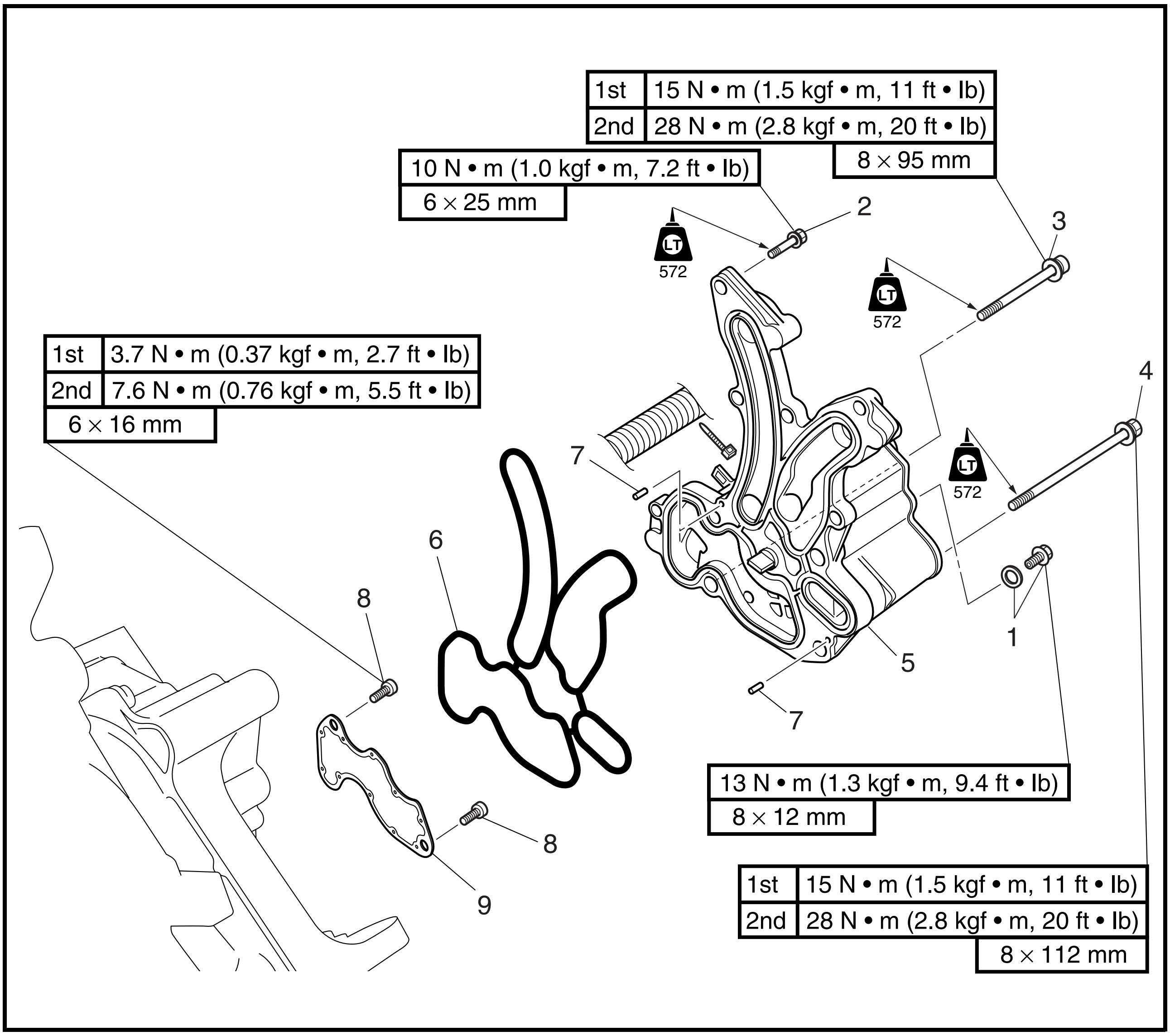

4. Install:
   - Oil tank

**NOTE:**
Tighten the oil tank nuts and bolts in the sequence shown.



**Bolt ①:**
**1st:**
**15 N • m (1.5 kgf • m, 11 ft • lb)**
**2nd:**
**39 N • m (3.9 kgf • m, 28 ft • lb)**
**LOCTITE 572**
**Nut ②, bolt ③:**
**1st:**
**2.0 N • m (0.2 kgf • m, 1.4 ft • lb)**
**2nd:**
**15 N • m (1.5 kgf • m, 11 ft • lb)**
**3rd:**
**39 N • m (3.9 kgf • m, 28 ft • lb)**
**LOCTITE 572**

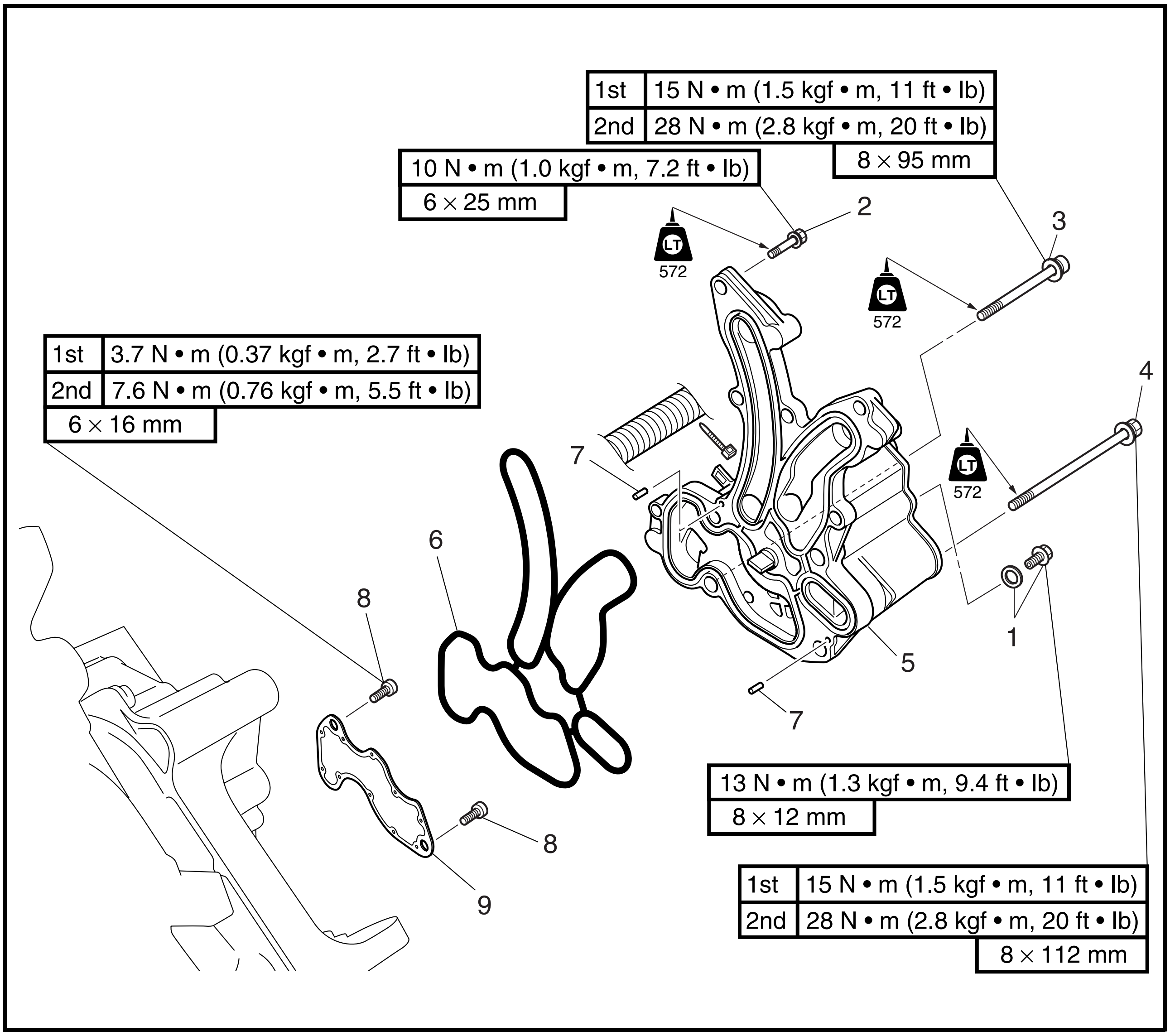
# OIL PUMP
## EXPLODED DIAGRAM



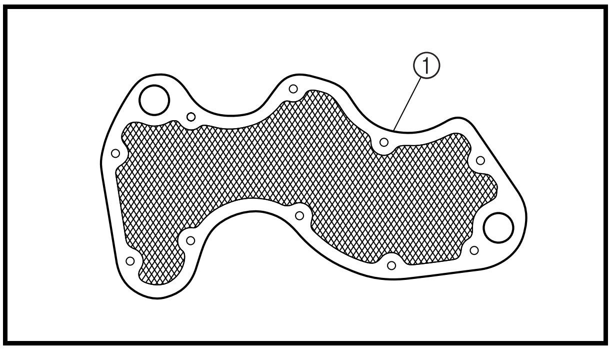

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **OIL PUMP ASSEMBLY REMOVAL** | | Follow the left "Step" for removal. |
| | Oil tank | | Refer to "OIL TANK". |
| 1 | Drain plug/washer | 1/1 | Drain engine oil. |
| 2 | Bolt | 6 | |
| 3 | Bolt | 2 | |
| 4 | Bolt | 2 | |
| 5 | Oil pump assembly | 1 | |
| 6 | Gasket | 1 | **Not reusable** |
| 7 | Pin | 2 | |

## EXPLODED DIAGRAM



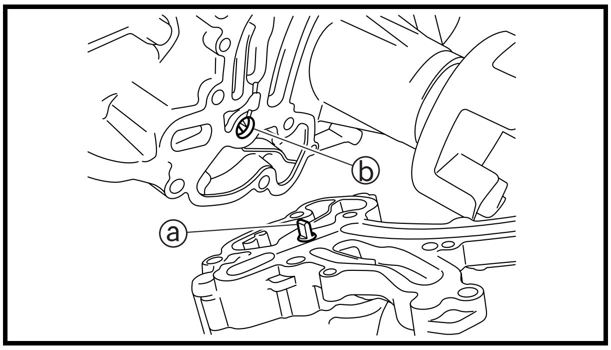

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Bolt | 2 | |
| 9 | Strainer | 1 | |
| | | | Reverse the removal steps for installation. |




## SERVICE POINTS

### Oil strainer inspection

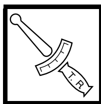
1. Check:
   - Oil strainer ①
     Damage → Replace.
     Contaminants → Clean.




### Oil pump installation

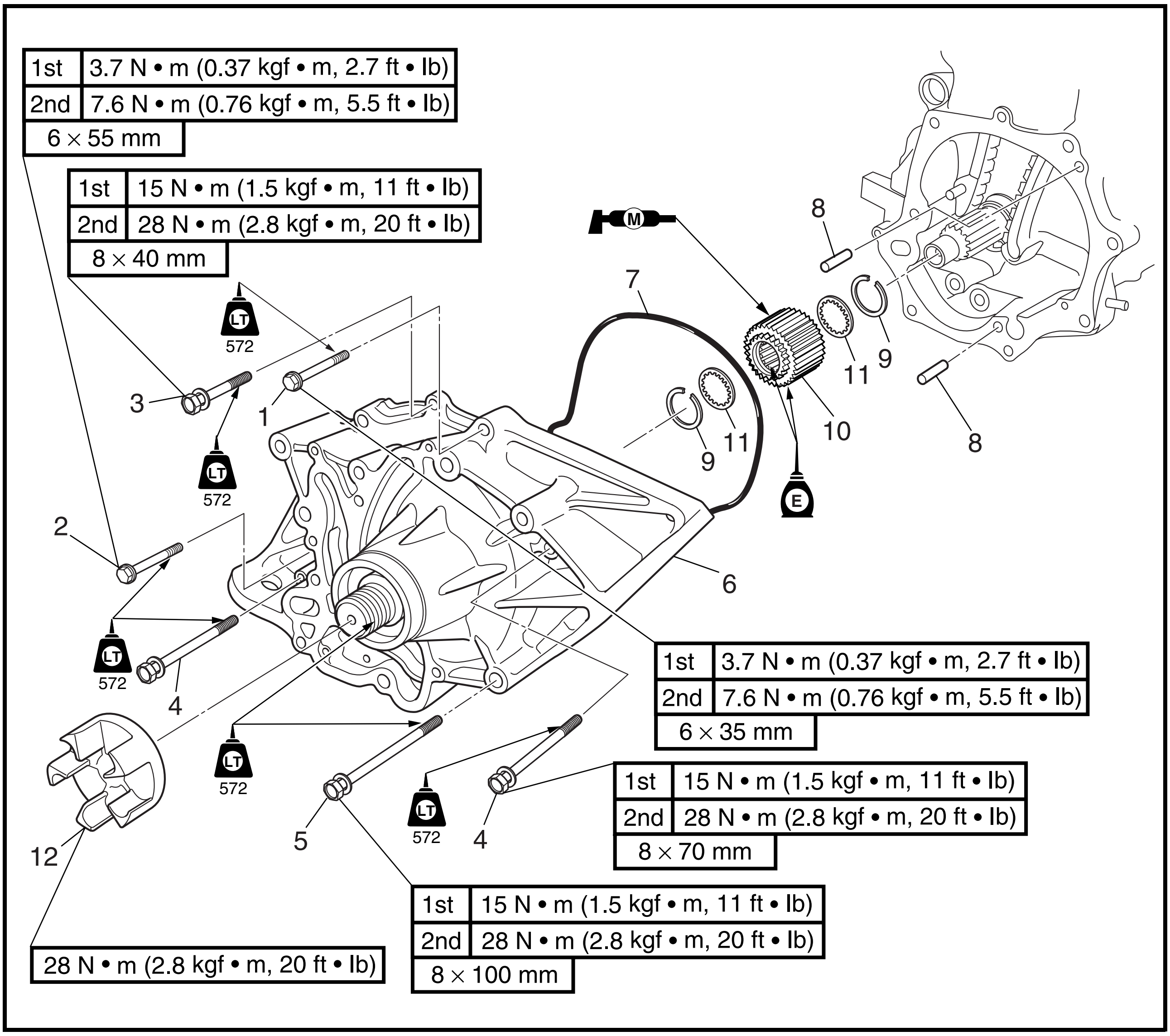
1. Install:
   - Oil pump assembly

**NOTE:**
Align the projection ⓐ on the oil pump shaft with the slit ⓑ on the oil pump driven gear shaft.



**Oil pump assembly bolt:**
**M6:**
**10 N • m (1.0 kgf • m, 7.2 ft • lb)**
**LOCTITE 572**
**M8:**
**1st:**
**15 N • m**
**(1.5 kgf • m, 11 ft • lb)**
**2nd:**
**28 N • m**
**(2.8 kgf • m, 20 ft • lb)**
**LOCTITE 572**

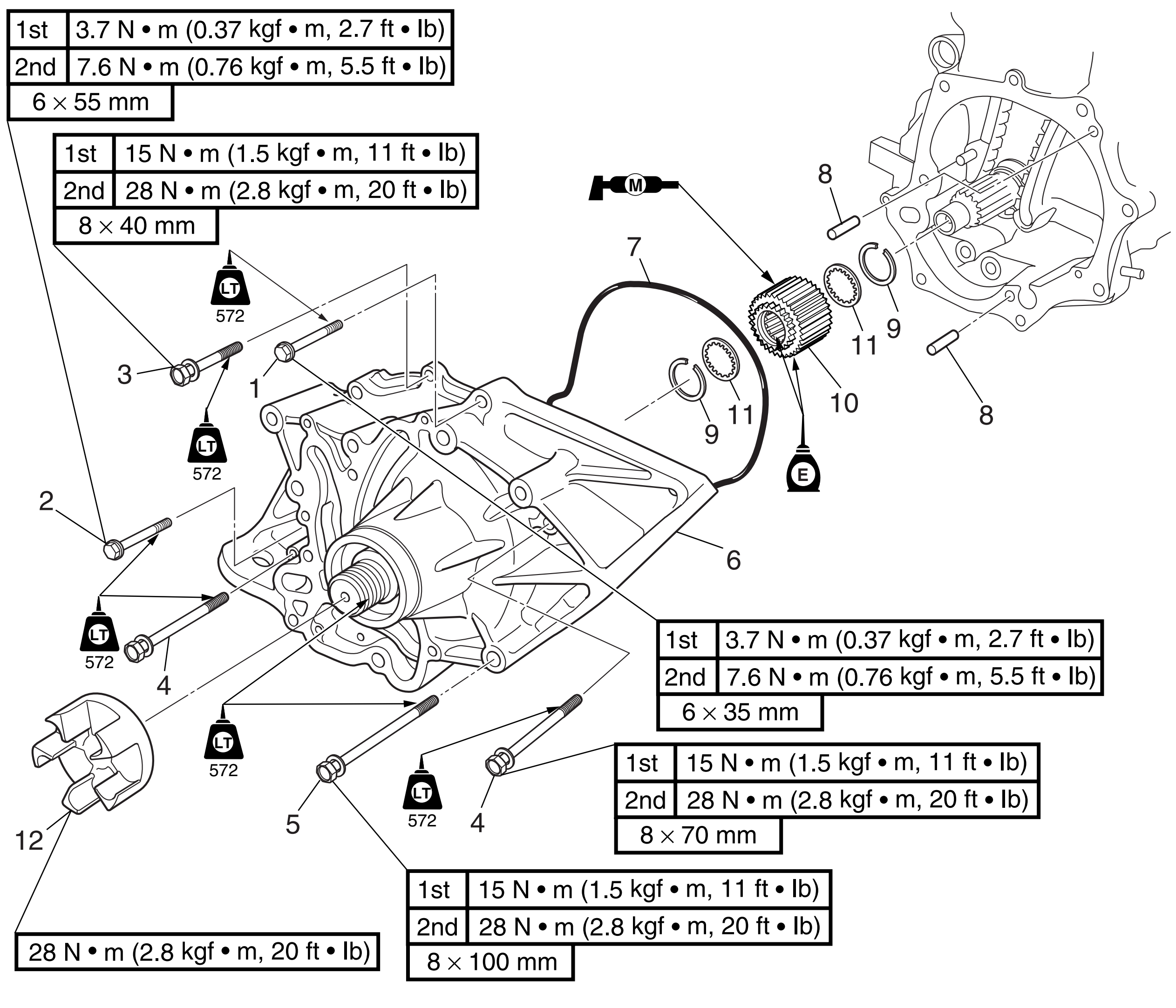
# REDUCTION DRIVE GEAR
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

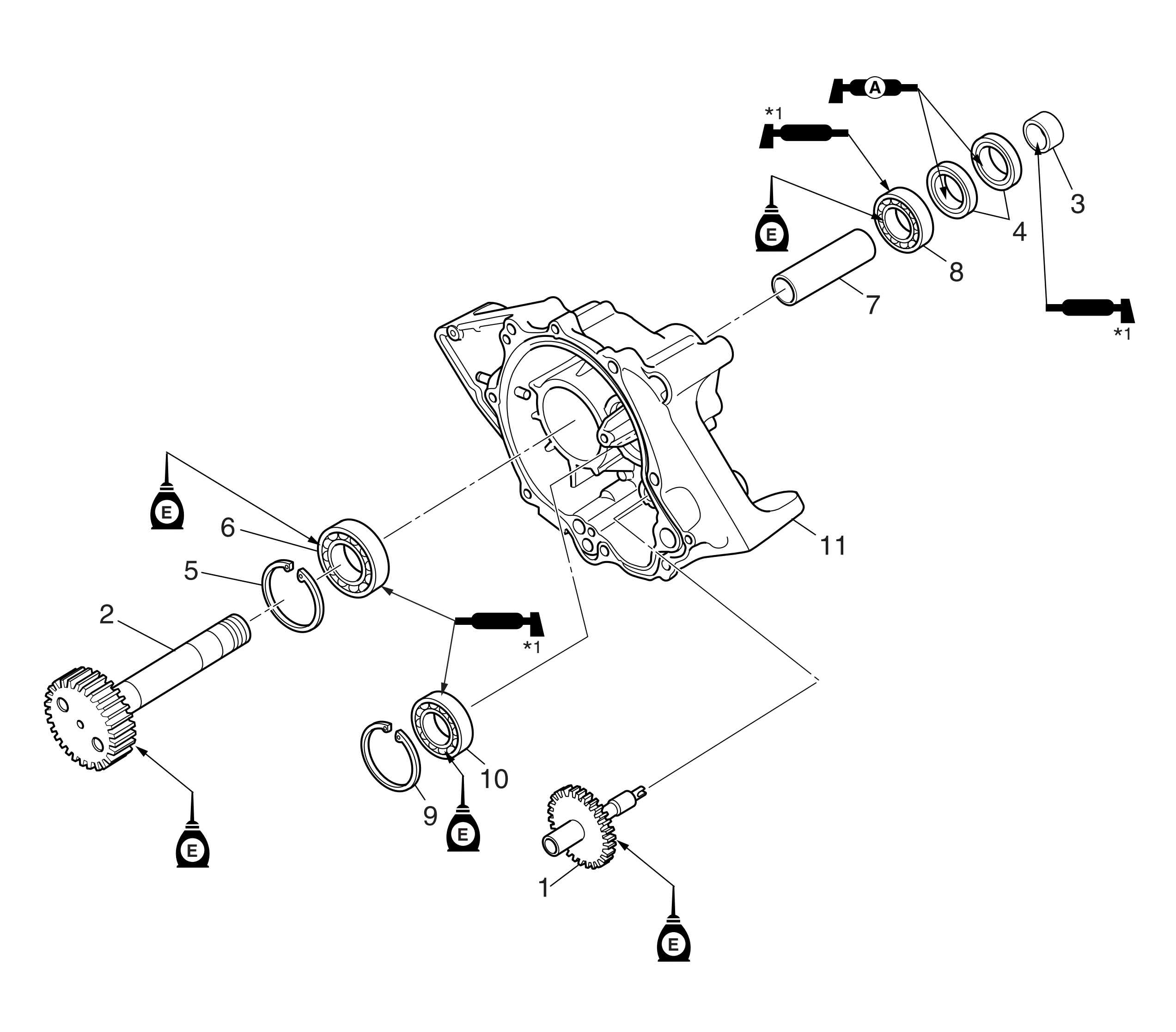
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **REDUCTION DRIVE GEAR REMOVAL** | | Follow the left "Step" for removal. |
| | Generator cover | | Refer to "GENERATOR AND STARTER MOTOR". |
| | Oil pump | | Refer to "OIL PUMP". |
| 1 | Bolt | 1 | |
| 2 | Bolt | 1 | |
| 3 | Bolt | 1 | |
| 4 | Bolt | 3 | |
| 5 | Bolt | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 6 | Reduction drive gear case assembly | 1 | |
| 7 | Gasket | 1 | **Not reusable** |
| 8 | Pin | 2 | |
| 9 | Circlip | 2 | **Not reusable** |
| 10 | Reduction drive gear | 1 | |
| 11 | Washer | 2 | |
| 12 | Drive coupling | 1 | |
| | | | Reverse the removal steps for installation. |

## EXPLODED DIAGRAM

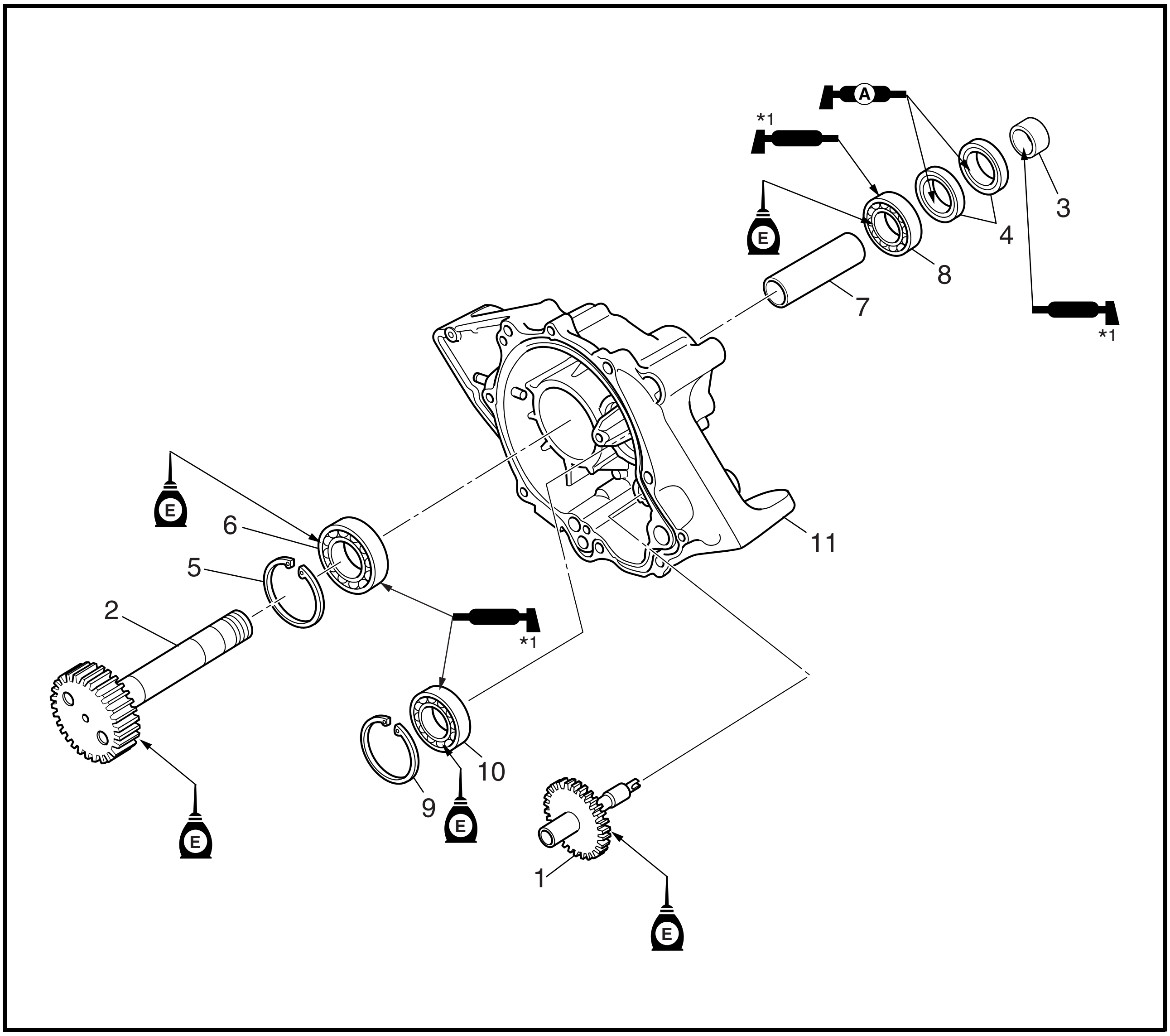



## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **REDUCTION DRIVE GEAR DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Oil pump drive shaft | 1 | |
| 2 | Drive shaft | 1 | |
| 3 | Collar | 1 | |
| 4 | Oil seal | 2 | **Not reusable** |
| 5 | Circlip | 1 | **Not reusable** |
| 6 | Bearing | 1 | **Not reusable** |
| 7 | Collar | 1 | |
| 8 | Bearing | 1 | **Not reusable** |

*1: EPNOC grease AP #0

## EXPLODED DIAGRAM

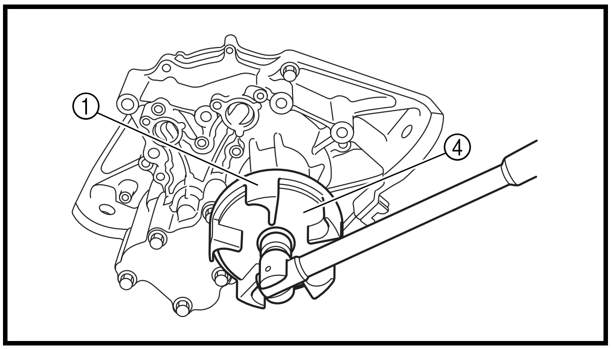



| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 9 | Circlip | 1 | **Not reusable** |
| 10 | Bearing | 1 | **Not reusable** |
| 11 | Reduction drive gear case | 1 | |
| | | | Reverse the disassembly steps for assembly. |

*1: EPNOC grease AP #0

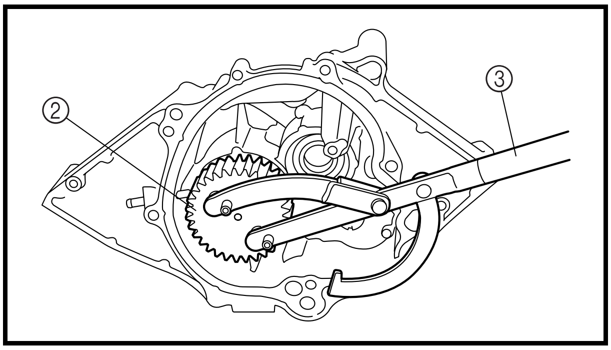
## SERVICE POINTS

### Drive coupling removal



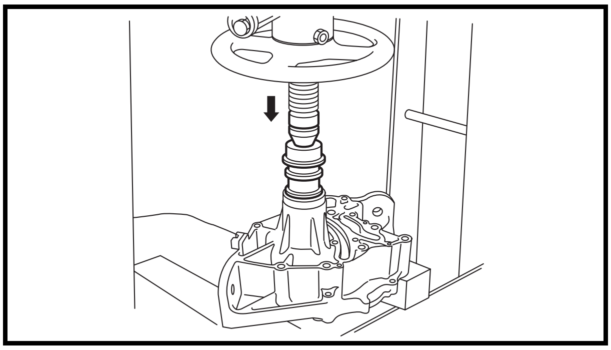

1. Remove:
   - Reduction drive gear housing
2. Remove:
   - Drive coupling ①

**NOTE:**
While holding the drive shaft ② with the rotor holder ③, loosen the drive coupling with the coupler wrench ④.




**Coupler wrench:**
**YW-06551/90890-06551**
**Universal magneto and rotor holder:**
**YU-01235**
**Rotor holder:**
**90890-01235**

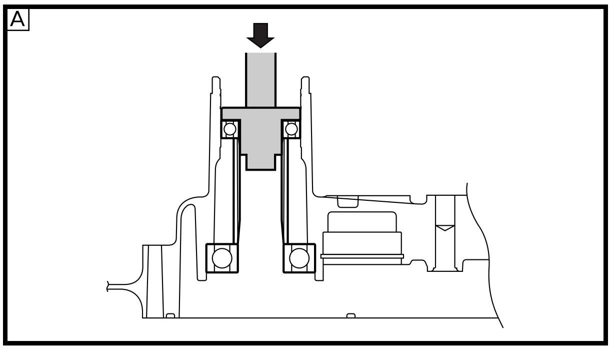
### Drive shaft removal



1. Remove:
   - Drive shaft

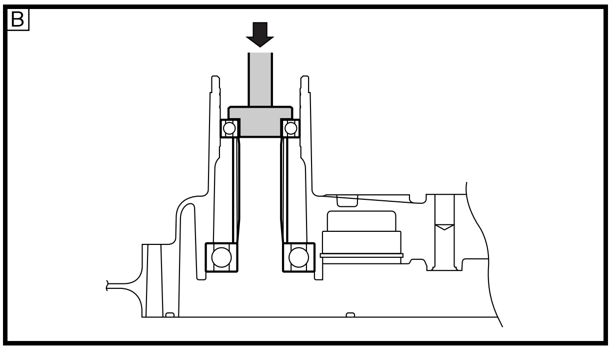
**NOTE:**
Press in the direction of the arrow.

### Bearing removal



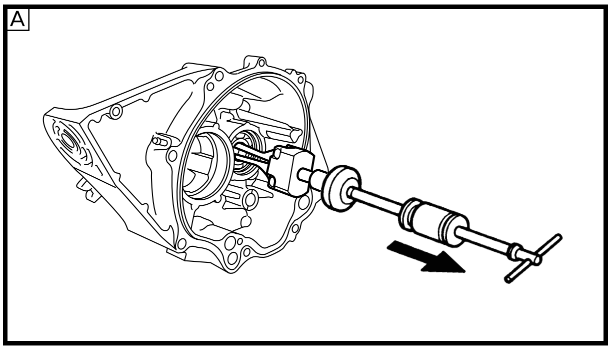

1. Remove:
   - Circlip
   - Rear bearing
   - Collar
   - Front bearing

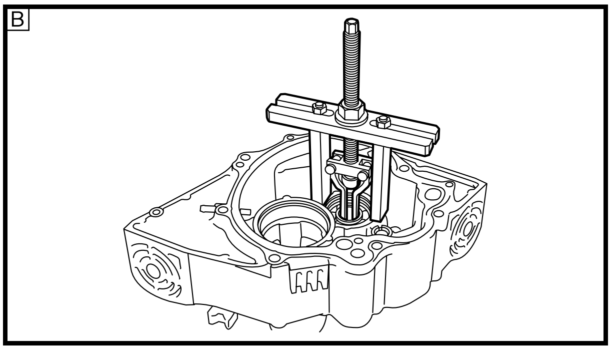
**NOTE:**
Remove the front bearing, spacer, and rear bearing using a press.




**Driver handle—large:**
**YB-06071**
**Driver rod L3:**
**90890-06652**
**Bearing housing needle bearing installer:**
**YB-06111**
**Needle bearing attachment:**
**90890-06653**

A For USA and Canada
B For worldwide



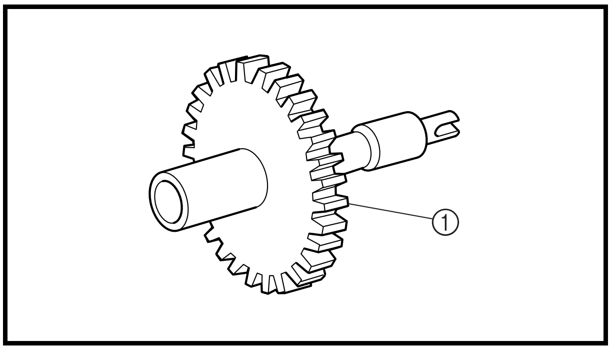




2. Remove:
   - Circlip
   - Reduction drive gear bearing

| Slide hammer and adapters: YB-06096 Stopper guide plate: 90890-06501 Bearing puller assembly: 90890-06535 Stopper guide stand: 90890-06538 |
|---|

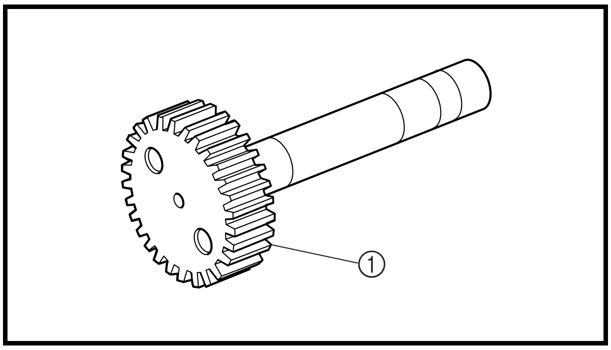
**Slide hammer and adapters:**
**YB-06096**
**Stopper guide plate:**
**90890-06501**
**Bearing puller assembly:**
**90890-06535**
**Stopper guide stand:**
**90890-06538**

A For USA and Canada
B For worldwide



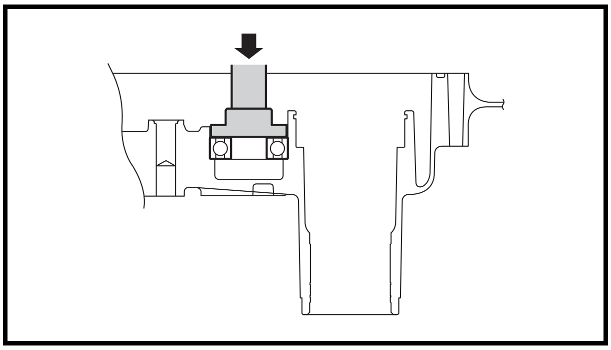

**Oil pump drive shaft inspection**

1. Check:
   - Oil pump drive shaft ①
     Cracks/damage/wear → Replace.




**Drive shaft inspection**

1. Check:
   - Drive shaft ①
     Cracks/damage/wear → Replace.



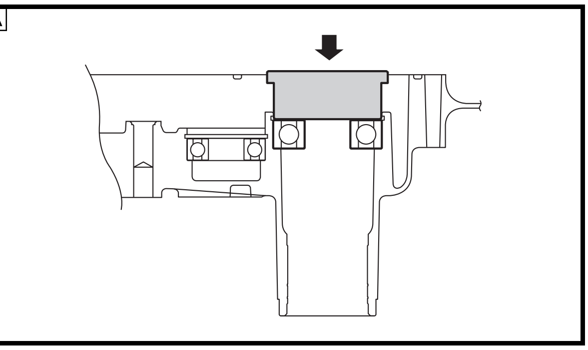
**Bearing installing**

1. Install:
   - Reduction drive gear bearing

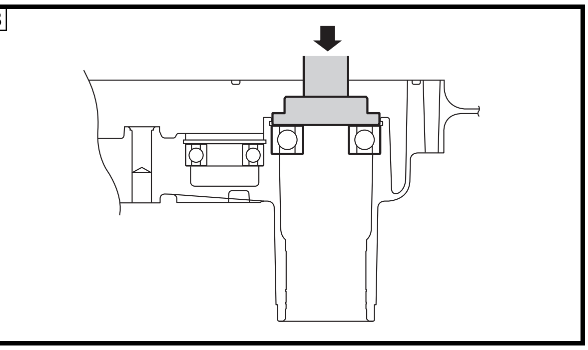
**NOTE:**
Install the reduction driver gear bearing using a press.

**Driver handle—large:**
**YB-06071**
**Driver rod LS:**
**90890-06606**
**Outer race installer—forward gear:**
**YB-06085**
**Ball bearing attachment:**
**90890-06631**

A



B

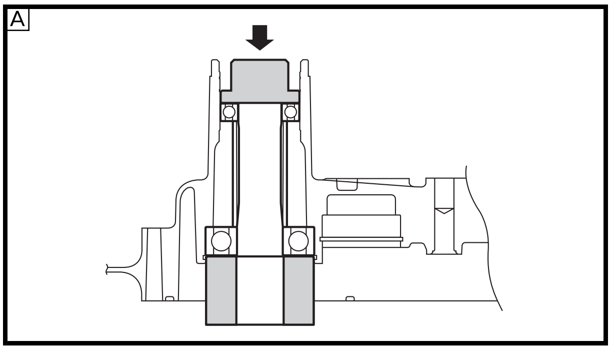


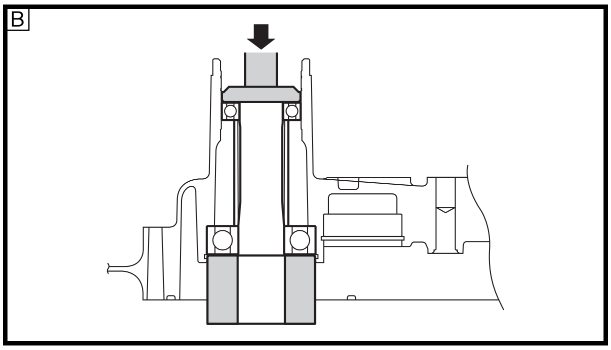
2. Install:
   - Front bearing

**NOTE:**
Install the front bearing using a press.

**Driver rod LS:**
**90890-06606**
**Forward gear bearing cup installer:**
**YB-06276-B**
**Ball bearing attachment:**
**90890-06657**

A For USA and Canada
B For worldwide



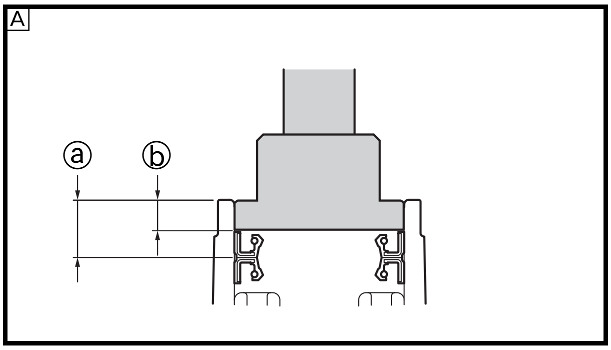



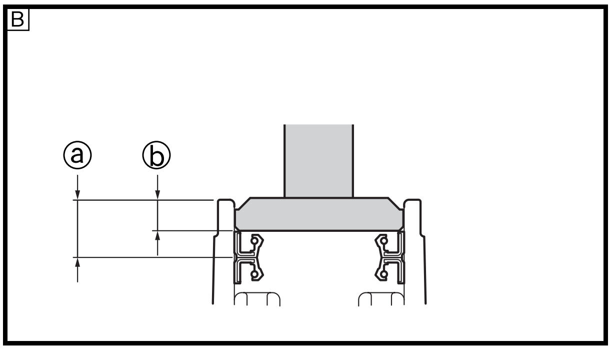

3. Install:
   - Collar
   - Rear bearing

**NOTE:**
- Install the front bearing using a press.
- Before installing the rear bearing, hold both the inner and outer races of the front bearing in place as shown with a pipe that is at least 40 mm (1.57 in) long and has an outer diameter of 70 mm (2.76 in) and an inner diameter of 30 mm (1.18 in).

**Driver rod LS:**
**90890-06606**
**Outer race installer—forward gear:**
**YB-06085**
**Bearing outer race attachment:**
**90890-06624**

A For USA and Canada
B For worldwide



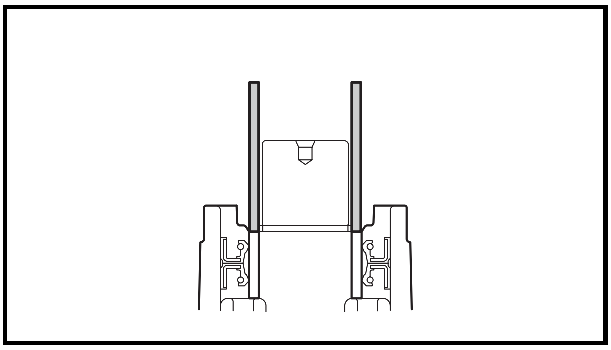




4. Install:
   - Oil seals

**Driver handle—large:**
**YB-06071**
**Driver rod LS:**
**90890-06606**
**Outer race installer—forward gear:**
**YB-06085**
**Bearing outer race attachment:**
**90890-06624**

A For USA and Canada
B For worldwide

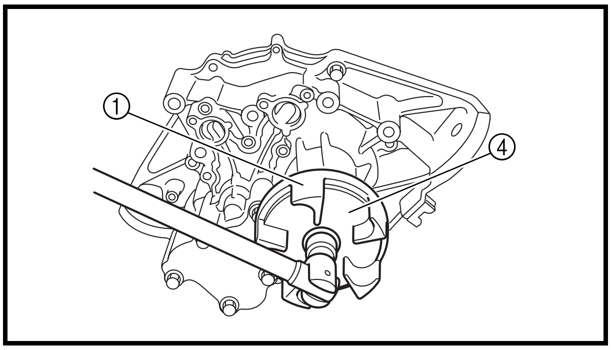
**Distance ⓐ:**
**17.9 ± 0.2 mm (0.70 ± 0.01 in)**
**Distance ⓑ:**
**9.3 ± 0.2 mm (0.37 ± 0.01 in)**

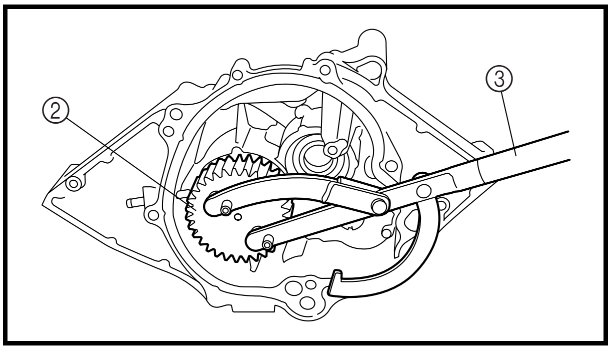


**Drive shaft installation**

1. Install:
   - Drive shaft
   - Collar

**NOTE:**
Press the into the reduction drive gear case using a pipe that is more than 30 mm (1.18 in) long, and which has an outer diameter of approximately 35 mm (1.97 in) and an inner diameter of approximately 28 ± 0.5 mm (1.10 ± 0.02 in).




**Drive coupling installation**

1. Install:
   - Drive coupling ①

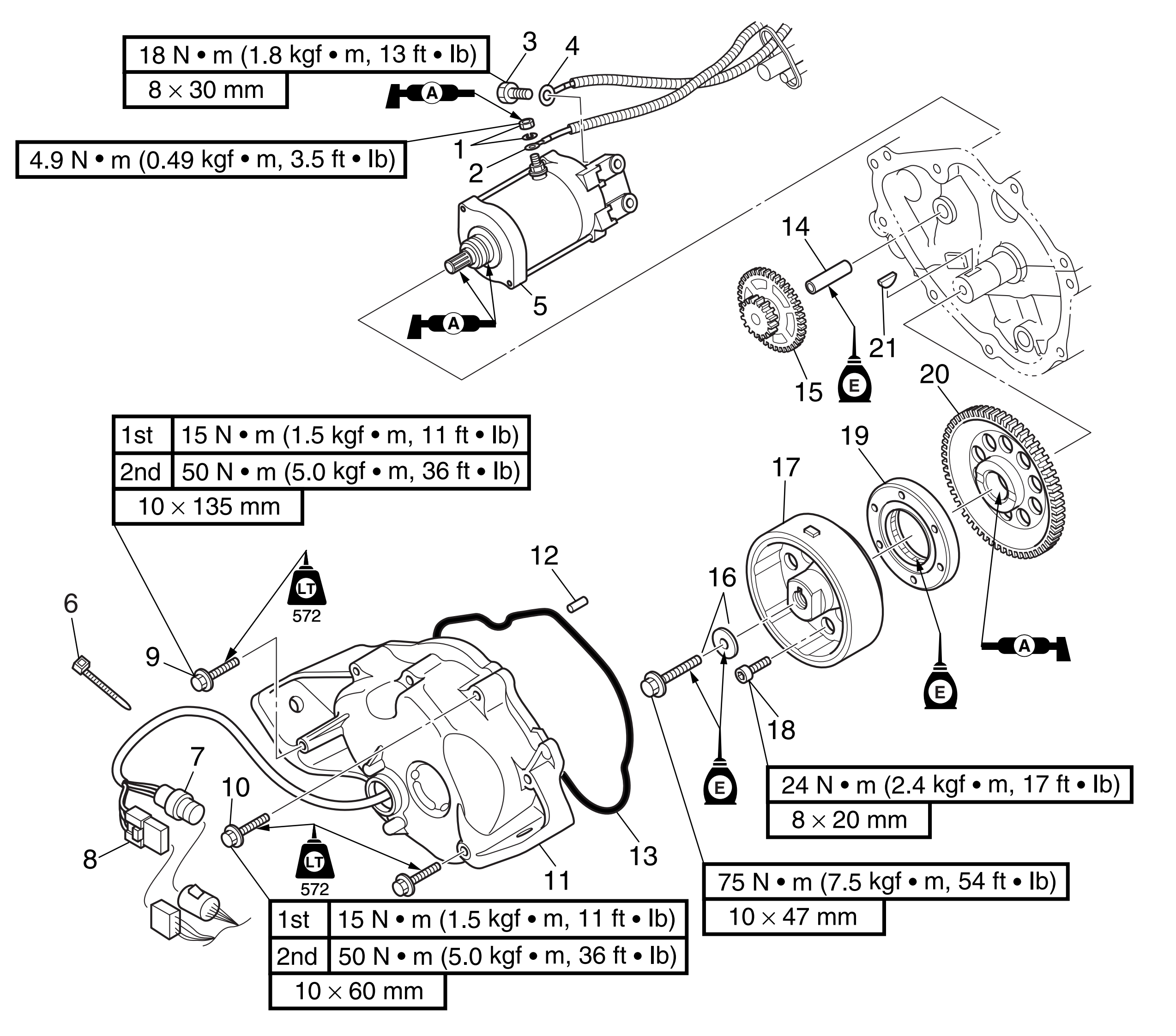
**NOTE:**
While holding the drive shaft ② with the rotor holder ③, tighten the drive coupling with the coupler wrench ④.

**Coupler wrench:**
**YW-06551/90890-06551**
**Universal magneto and rotor holder:**
**YU-01235**
**Rotor holder:**
**90890-01235**

**Drive coupling:**
**28 N • m (2.8 kgf • m, 20 ft • lb)**
**LOCTITE 572**

2. Install:
   - Reduction drive gear housing

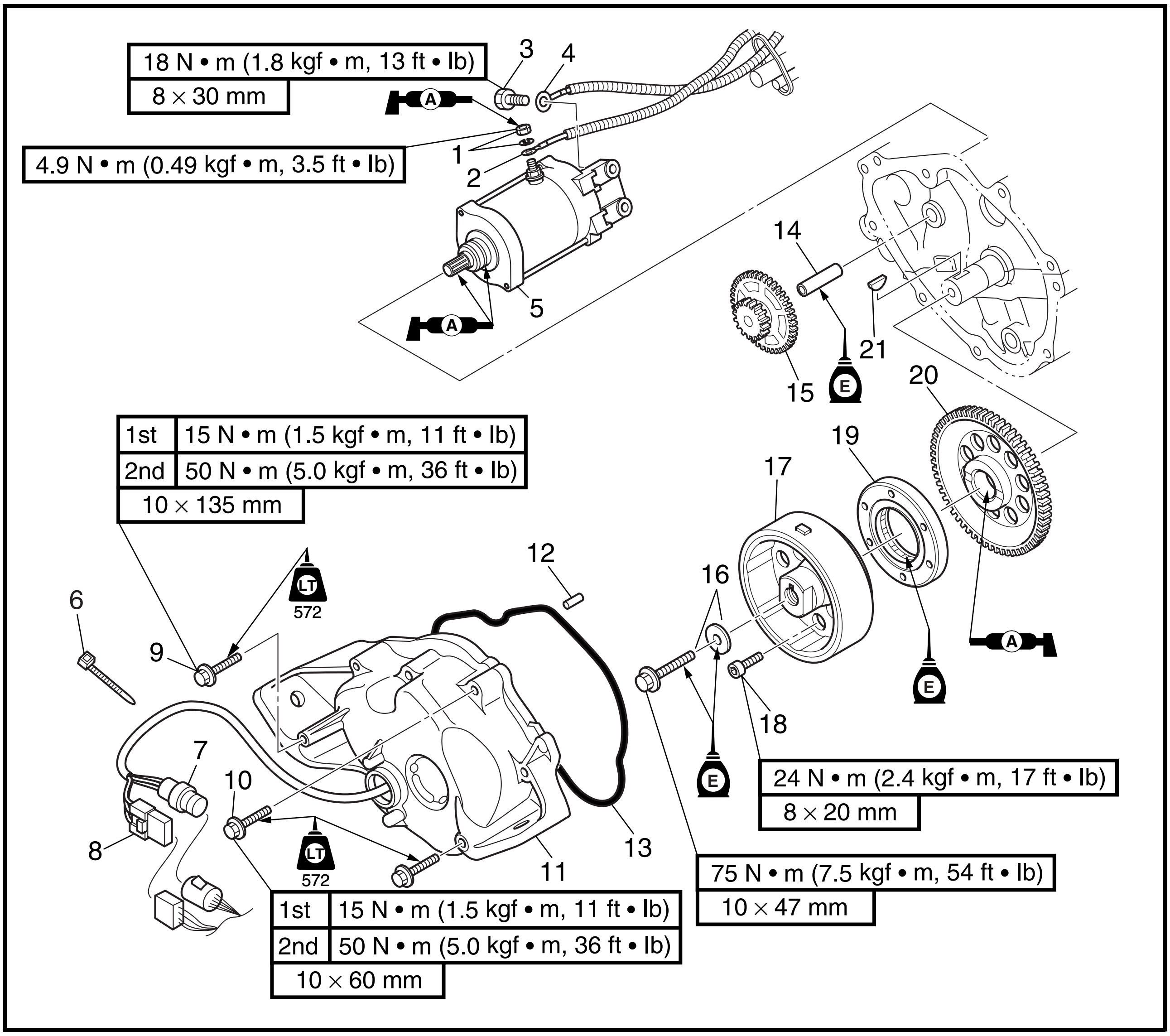
# GENERATOR AND STARTER MOTOR
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

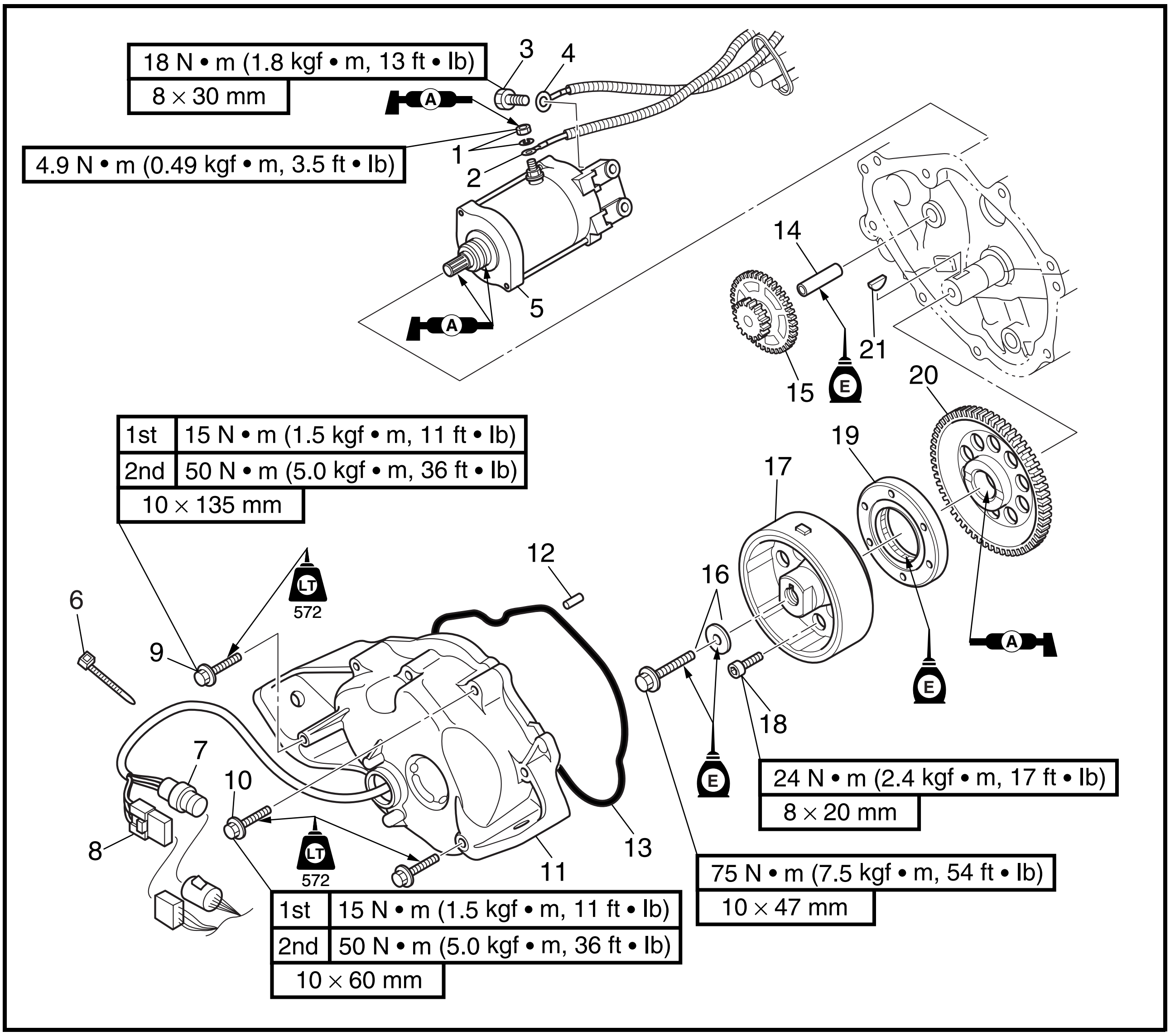
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **GENERATOR COVER AND FLYWHEEL MAGNETO REMOVAL** | | Follow the left "Step" for removal. |
| | Engine unit | | Refer to "ENGINE UNIT". |
| 1 | Nut/washer | 1/1 | |
| 2 | Starter motor lead | 1 | |
| 3 | Bolt | 2 | |
| 4 | Battery negative lead | 1 | |
| 5 | Starter motor | 1 | |
| 6 | Band | 1 | |
| 7 | Lighting coil coupler | 1 | |

## EXPLODED DIAGRAM



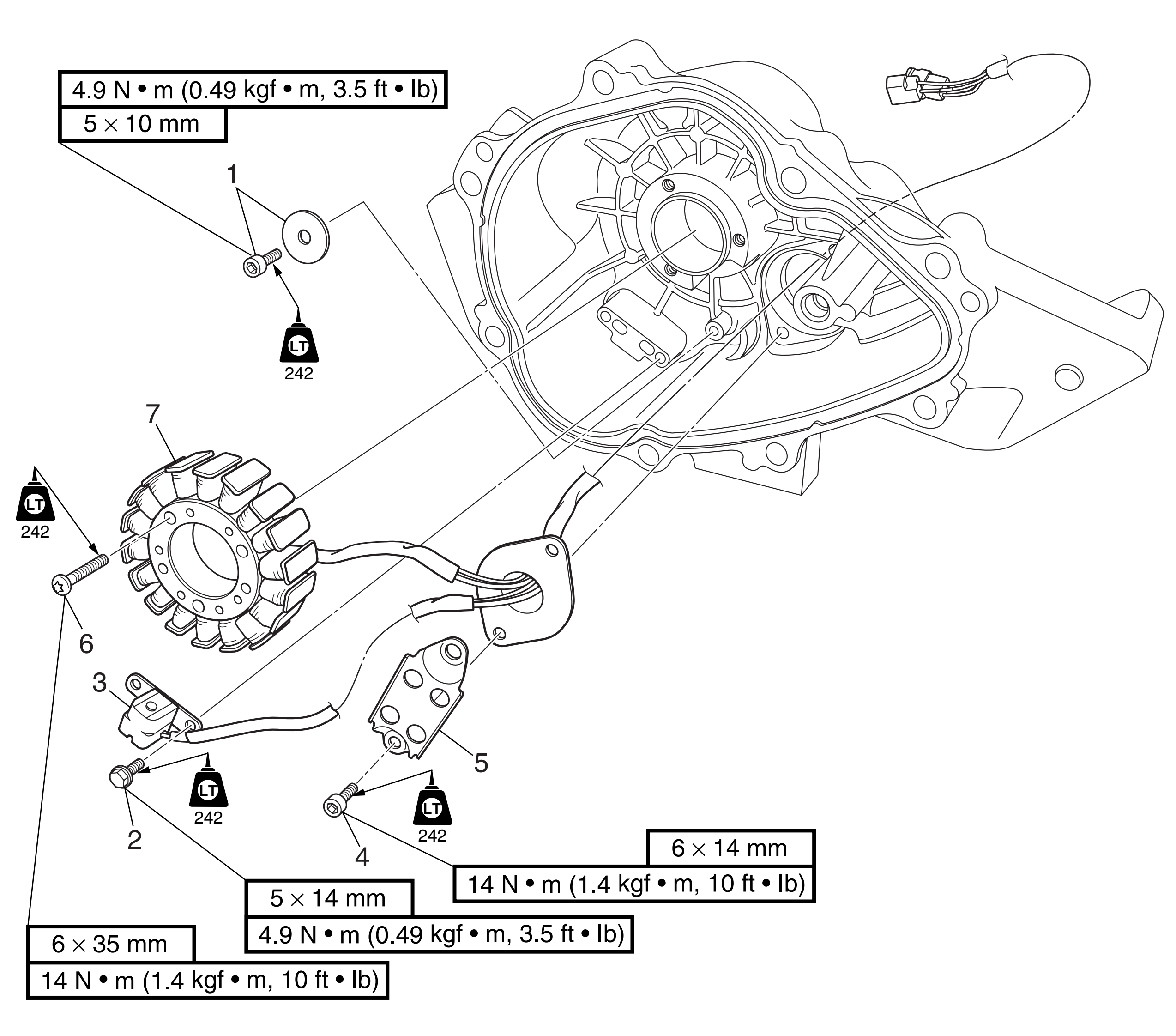

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Pickup coil coupler | 1 | |
| 9 | Bolt | 6 | |
| 10 | Bolt | 2 | |
| 11 | Generator cover | 1 | |
| 12 | Dowel pin | 2 | |
| 13 | Gasket | 1 | **Not reusable** |
| 14 | Idle gear shaft | 1 | |
| 15 | Idle gear | 1 | |
| 16 | Bolt/washer | 1/1 | **Not reusable** |
| 17 | Flywheel magneto | 1 | |
| 18 | Bolt | 6 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 19 | Starter clutch | 1 | |
| 20 | Starter gear | 1 | |
| 21 | Woodruff key | 1 | |
| | | | Reverse the removal steps for installation. |

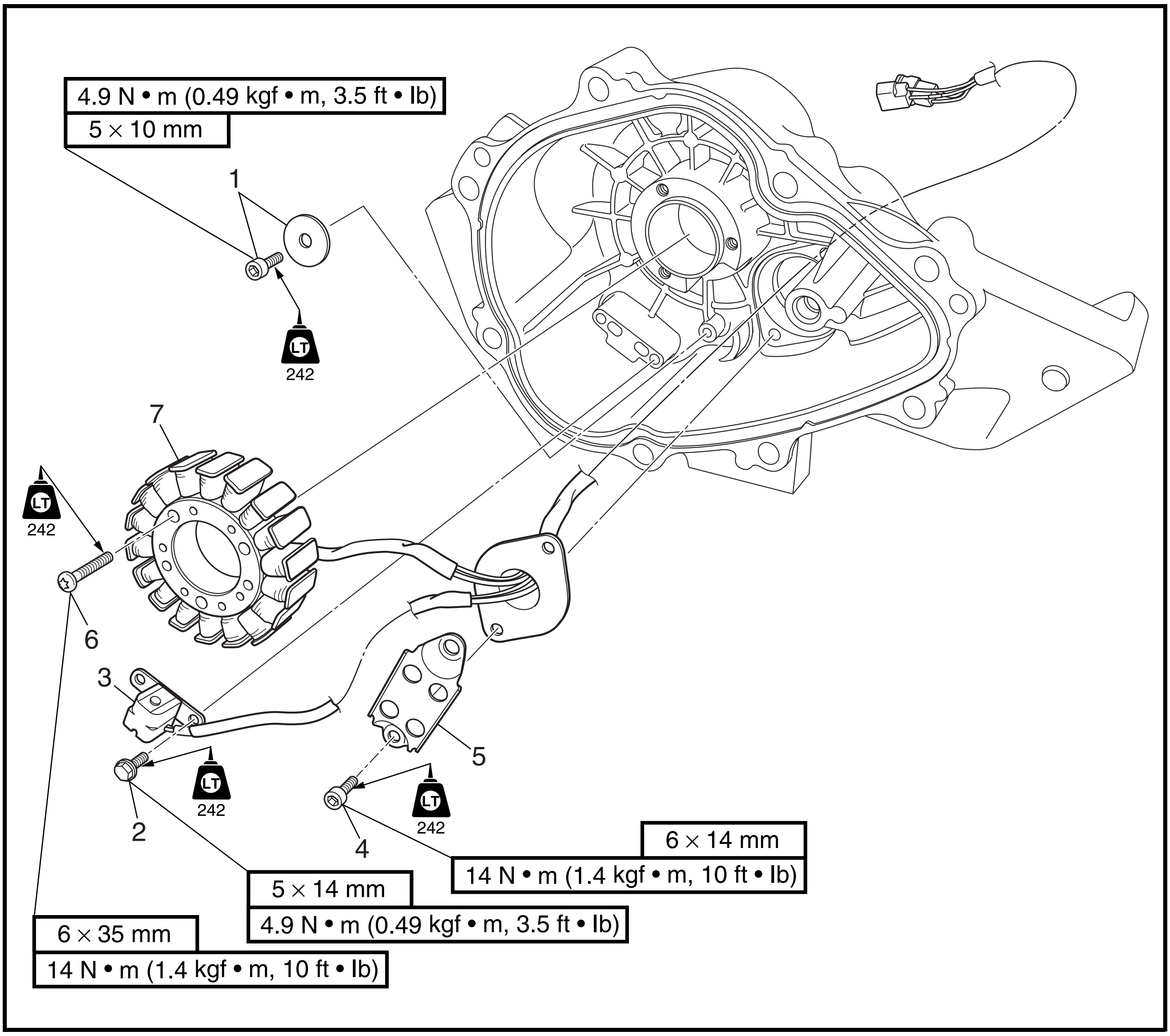
## EXPLODED DIAGRAM



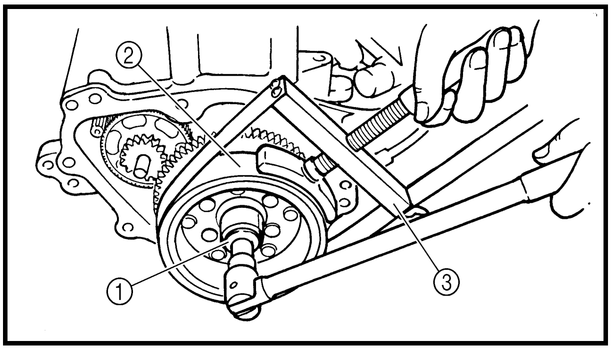

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **GENERATOR DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Bolt/washer | 1/1 | |
| 2 | Bolt | 2 | |
| 3 | Pickup coil | 1 | **NOTE:** There washer hold the pickup coil lead. Make sure to not pitch the lead between the projection and the washer when installing the bolt. |
| 4 | Bolt | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 5 | Holder | 1 | |
| 6 | Bolt | 3 | |
| 7 | Lighting coil | 1 | |
| | | | Reverse the disassembly steps for assembly. |



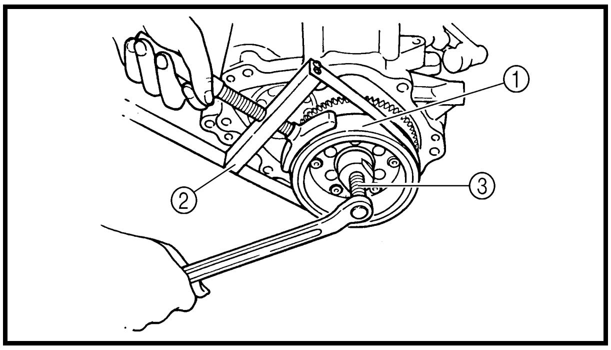

## SERVICE POINTS

### Flywheel magneto removal

1. Remove:
   - Flywheel magneto bolt ①
   - Washer

**NOTE:**
While holding the flywheel magneto ② with the sheave holder ③, loosen the flywheel magneto bolt.

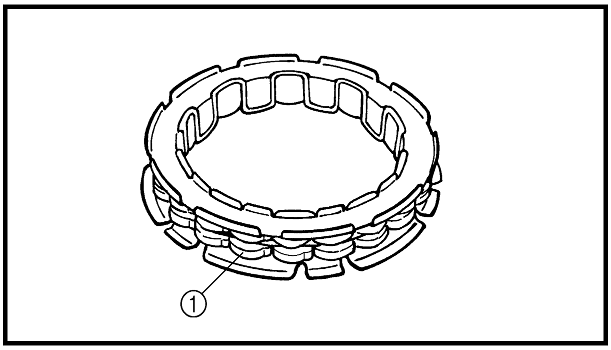
| | |
|---|---|
| | **Sheave holder:** **YS-01880-A/90890-01701** |




2. Remove:
   - Flywheel magneto ①
   - Woodruff key

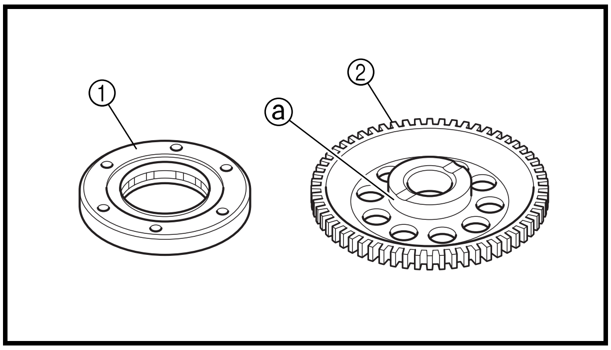
**NOTE:**
While holding the flywheel magneto with sheave holder ②, remove the flywheel magneto with the rotor puller ③.

| | |
|---|---|
| | **Rotor puller:** **YM-01082/90890-01080** |

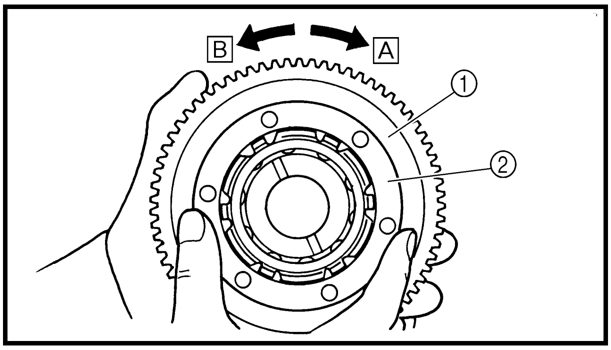



### Starter clutch inspection

1. Check:
   - Starter clutch rollers ①
     Damage/wear → Replace.




2. Check:
   - Starter clutch ①
   - Starter gear ②
     Burrs/chips/roughness/wear → Replace the defective part(s).
3. Check:
   - Starter clutch gear's contacting surfaces ⓐ
     Damage/pitting/wear → Replace the starter clutch gear.



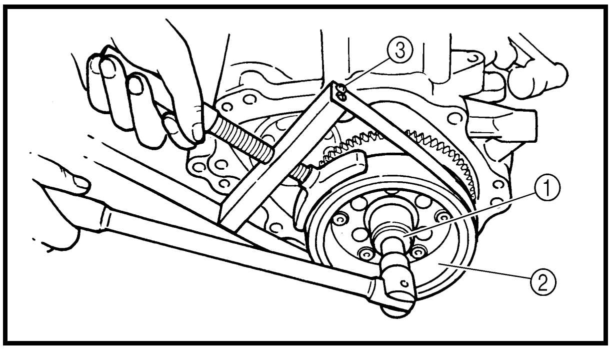

4. Check:
   - Starter clutch operation

**Checking steps:**
- Install the starter gear ① onto the starter clutch ② and hold the starter clutch.
- When turning the starter gear clockwise [A], it should turn freely, otherwise the starter clutch is faulty and must be replaced.
- When turning the starter gear counterclockwise [B], the starter clutch and the starter gear should engage, otherwise the starter clutch is faulty and must be replaced.

**Flywheel magneto installation**

1. Install:
   - Woodruff key
   - Flywheel magneto
   - Washer
   - Flywheel magneto bolt

**NOTE:**
- Clean the tapered portion of the crankshaft and the flywheel magneto hub.
- When installing the flywheel magneto, make sure the woodruff key is properly seated in the keyway of the crankshaft.
- Lubricate the flywheel magneto bolt and washer with engine oil.




2. Tighten:
   - Flywheel magneto bolt ①

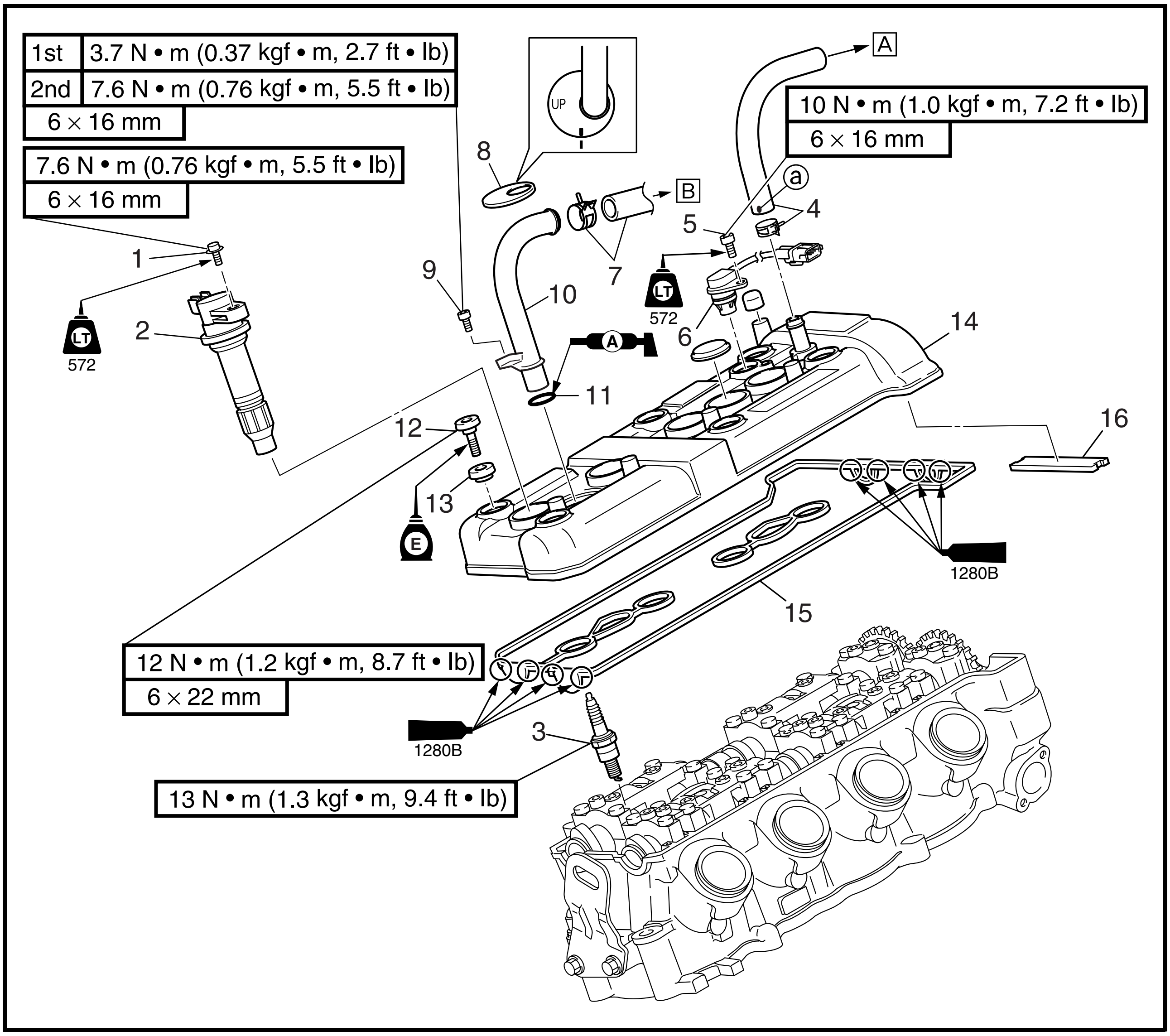
**NOTE:**
While holding the flywheel magneto ② with the sheave holder ③, tighten the flywheel magneto bolt.

| | |
|---|---|
| | **Flywheel magneto bolt:**<br>**75 N • m (7.5 kgf • m, 54 ft • lb)** |
| | **Sheave holder:**<br>**YS-01880-A/90890-01701** |

**CAUTION:**

**Do not reuse the flywheel magneto bolt and washer, always replace them with new ones.**

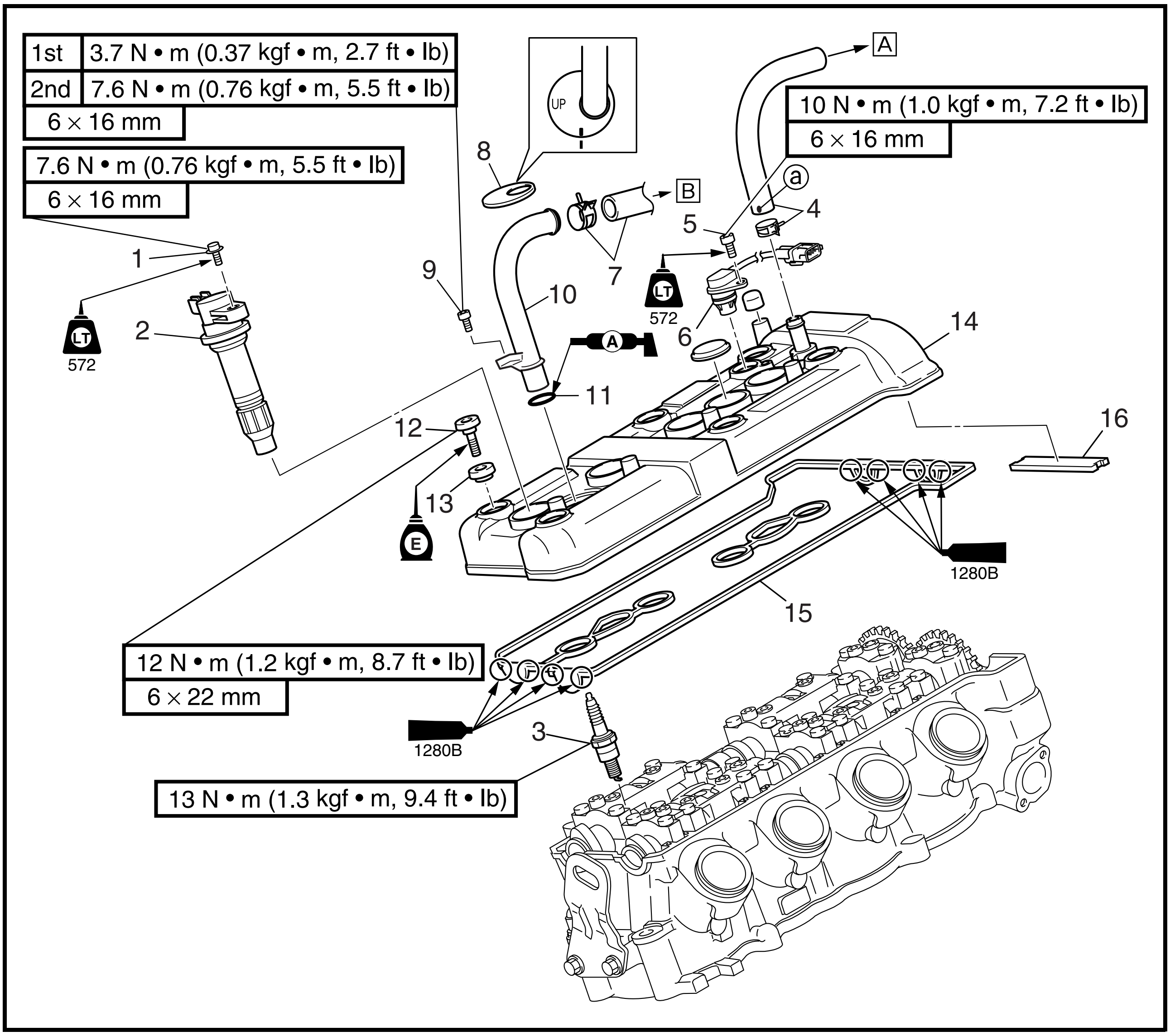
# CAMSHAFTS
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

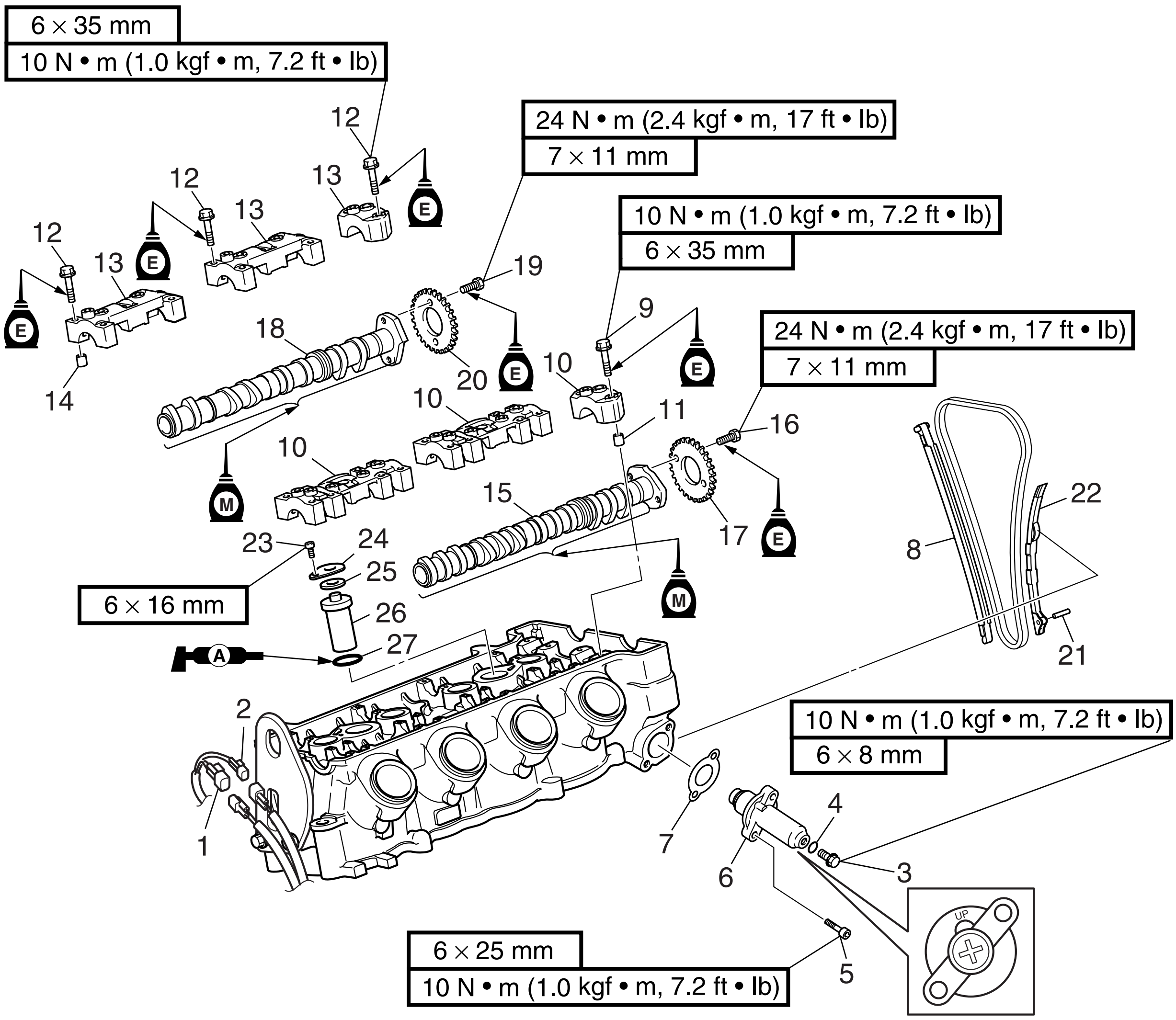
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **CYLINDER HEAD COVER REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Bolt | 4 | |
| 2 | Ignition coil | 4 | |
| 3 | Spark plug | 4 | |
| 4 | Clamp/breather hose | 1/1 | A To oil tank<br>Paint mark ⓐ |
| 5 | Bolt | 1 | |
| 6 | Cam position sensor | 1 | |
| 7 | Clamp/cooling water hose | 1/1 | B To transom plate |
| 8 | Rubber seal | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 9 | Bolt | 1 | |
| 10 | Cooling water pipe | 1 | |
| 11 | O-ring | 1 | **Not reusable** |
| 12 | Bolt | 6 | |
| 13 | Rubber mount | 6 | |
| 14 | Cylinder head cover | 1 | |
| 15 | Cylinder head cover gasket | 1 | **Not reusable** |
| 16 | Timing chain guide (top side) | 1 | |
| | | | Reverse the removal steps for installation. |

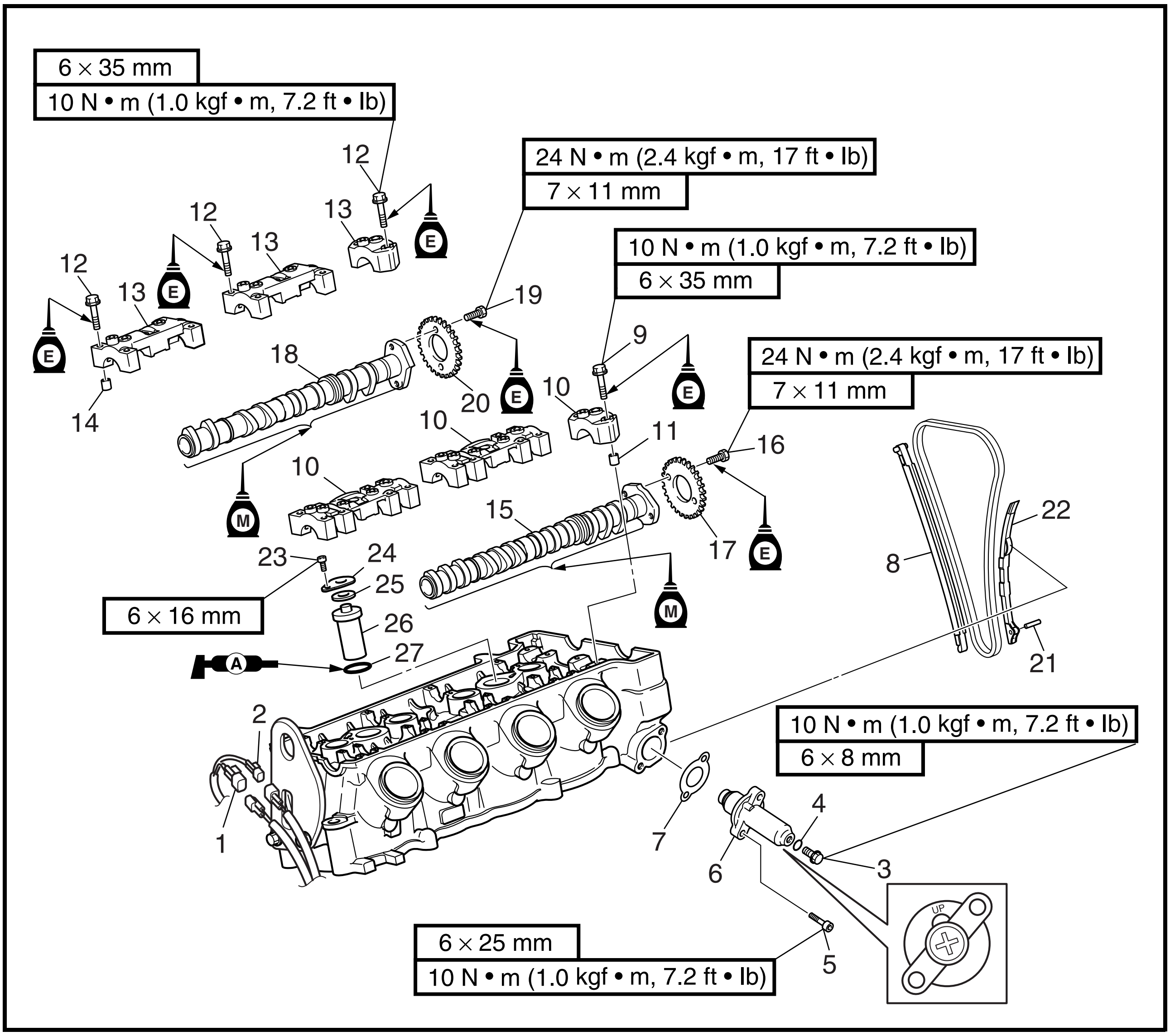
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

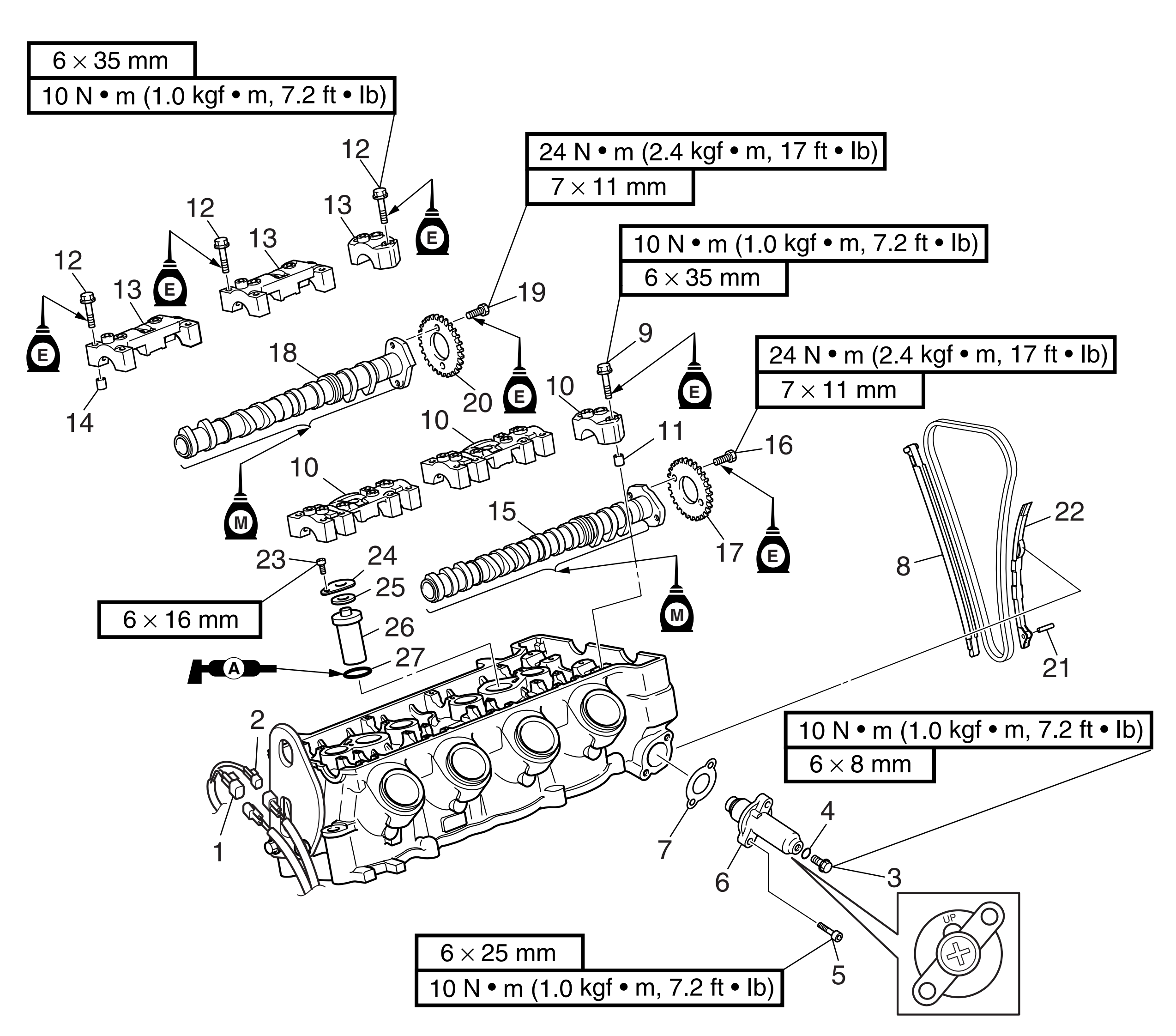
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **CAMSHAFT REMOVAL** | | Follow the left "Step" for removal. |
| | Cylinder head cover | | |
| | Reduction drive gear case | | Refer to "REDUCTION DRIVE GEAR".<br>**NOTE:**<br>When removing camshafts it is not necessary to remove the reduction drive gear case. |
| 1 | Thermoswitch (engine) coupler | 1 | |
| 2 | Engine temperature sensor coupler | 1 | |
| 3 | Cap bolt | 1 | |
| 4 | Gasket | 1 | **Not reusable** |
| 5 | Bolt | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 6 | Timing chain tensioner | 1 | |
| 7 | Timing chain tensioner gasket | 1 | **Not reusable** |
| 8 | Timing chain guide (exhaust side) | 1 | |
| 9 | Bolt | 18 | |
| 10 | Intake camshaft cap | 3 | |
| 11 | Dowel pin | 6 | **NOTE:** |
| 12 | Bolt | 10 | During removal, the dowel pins may still be |
| 13 | Exhaust camshaft cap | 3 | connected to the camshaft caps. |
| 14 | Dowel pin | 6 | |
| 15 | Intake camshaft | 1 | |
| 16 | Bolt | 2 | |
| 17 | Intake camshaft sprocket | 1 | |

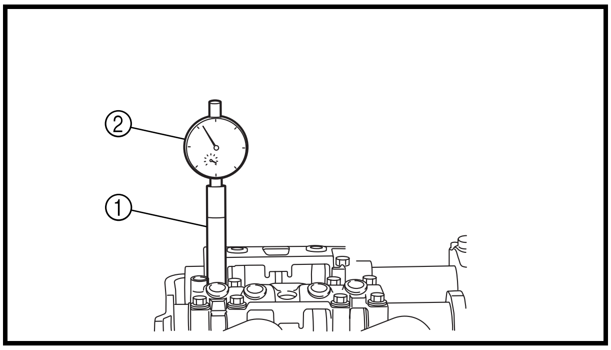
## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 18 | Exhaust camshaft | 1 | |
| 19 | Bolt | 2 | |
| 20 | Exhaust camshaft sprocket | 1 | |
| 21 | Pin | 1 | |
| 22 | Timing chain guide (intake side) | 1 | |
| 23 | Bolt | 1 | |
| 24 | Plate | 1 | |
| 25 | Gasket | 1 | |
| 26 | Pipe | 1 | |
| 27 | O-ring | 1 | **Not reusable** |
| | | | Reverse the removal steps for installation. |

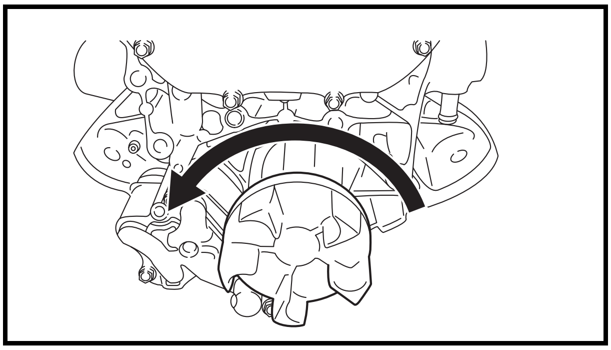
## SERVICE POINTS

### Camshaft removal

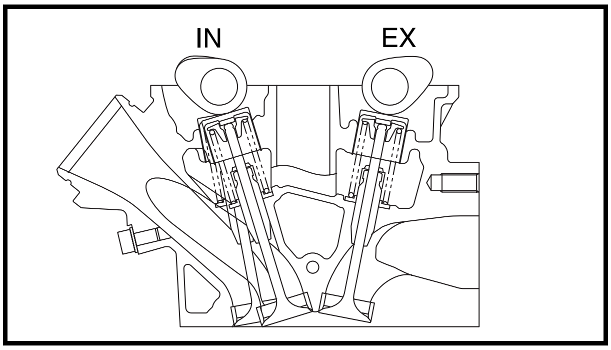



1. Install:
   - Dial gauge needle
   - Dial gauge stand ①
     (into spark plug hole #1)
   - Dial gauge ②

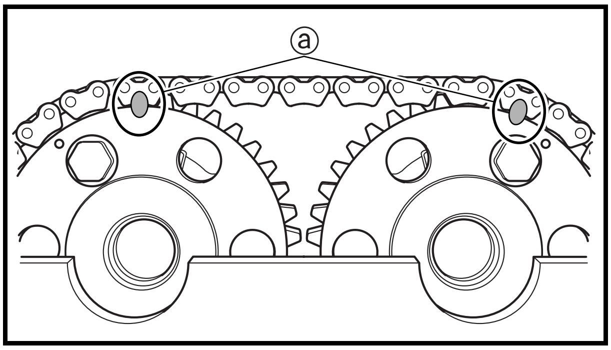
**Dial gauge stand:**
**90890-06583**
**Dial gauge needle:**
**90890-06584**
**Dial gauge stand set:**
**YB-06585/90890-06585**
**Dial indicator gauge:**
**YU-03097**
**Dial gauge set:**
**90890-01252**



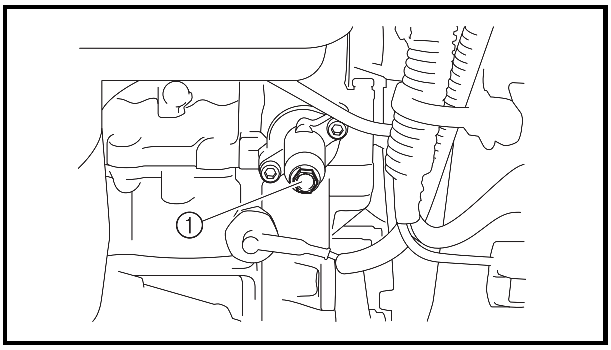
2. Turn the drive coupling counterclockwise, and then check if cylinder #1 is at TDC of the compression stroke with a dial gauge.



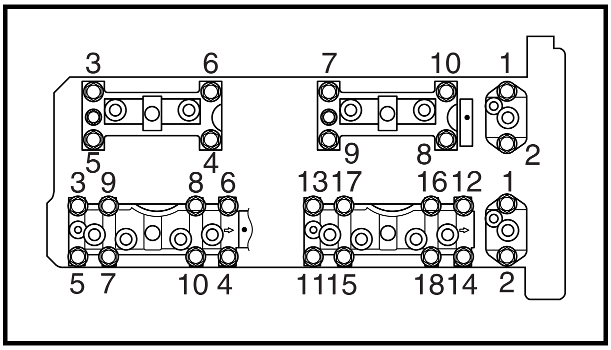

**NOTE:**
TDC on the compression stroke can be found when the camshaft lobes are turned away from each other.




3. Make the alignment marks ⓐ on the timing chain and camshaft sprockets.

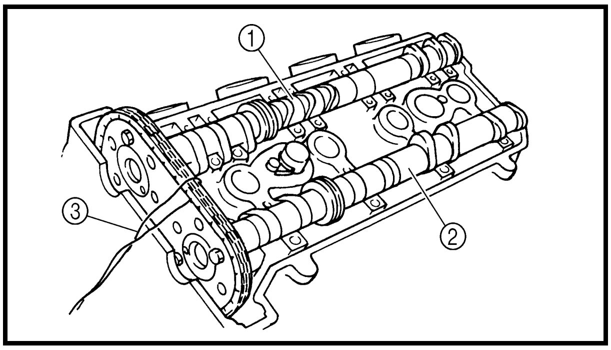



4. Remove:
   - Timing chain tensioner ①
   - Gasket



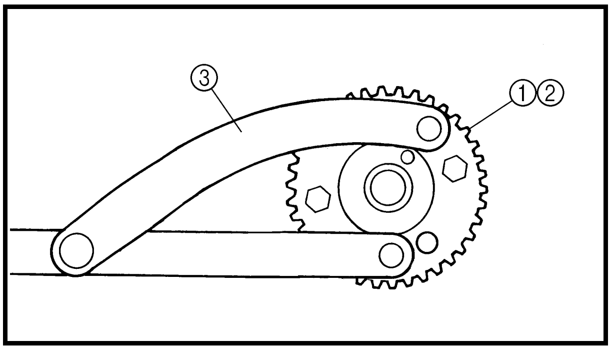

5. Remove:
   - Camshaft caps
   - Dowel pins

**NOTE:**
Loosen the intake and exhaust camshaft cap bolts in the sequence shown.




6. Remove:
   - Intake camshaft ①
   - Exhaust camshaft ②

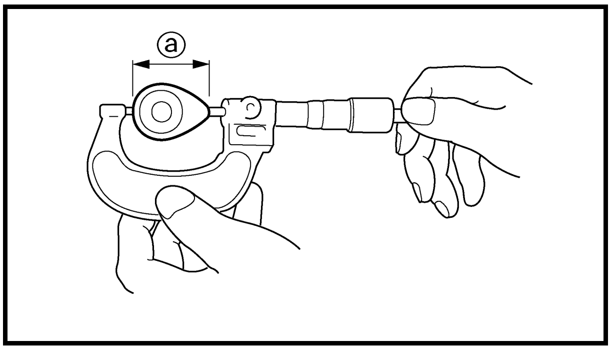
**NOTE:**
To prevent the timing chain from falling into the crankcase, fasten it with a wire ③.




7. Remove:
   - Exhaust camshaft sprocket ①
   - Intake camshaft sprocket ②
     (with the special service tool ③)

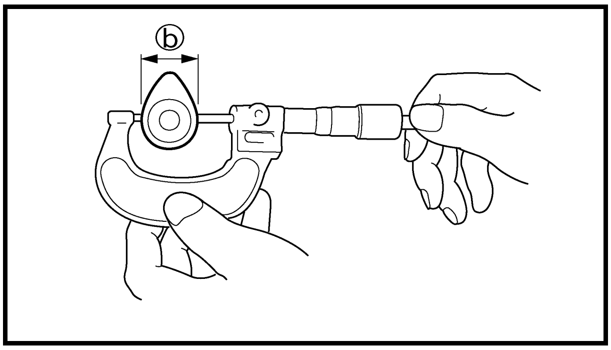
| **Universal magneto and rotor holder:**<br>**YU-01235**<br>**Rotor holder:**<br>**90890-01235** |
|---|

**Camshaft inspection**

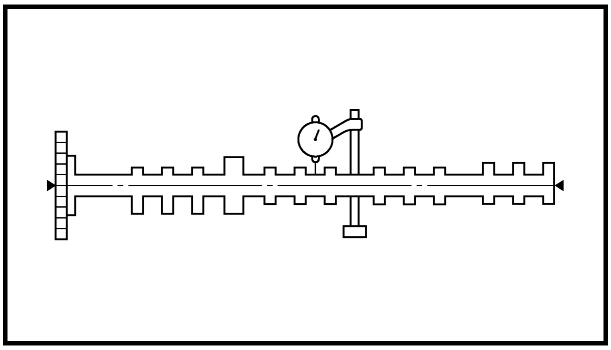



1. Check:
   - Camshaft lobes
     Bluediscoloration/pitting/scratches → Replace the camshaft.

2. Measure:
   - Camshaft lobe dimensions ⓐ and ⓑ
     Out of specification → Replace the camshaft.

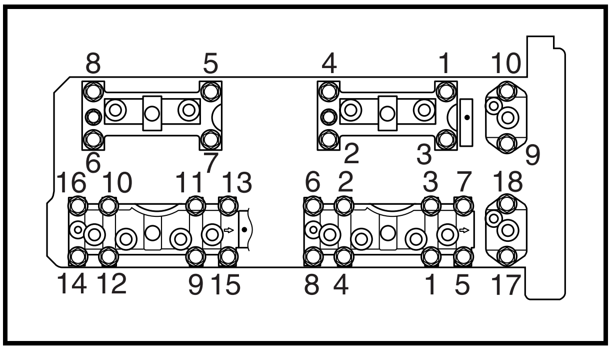



| **Cam lobe dimensions:**<br>**Intake camshaft:**<br>**ⓐ 31.15 mm (1.226 in)**<br>**ⓑ 25.00 mm (0.984 in)**<br>**Exhaust camshaft:**<br>**ⓐ 30.75 mm (1.211 in)**<br>**ⓑ 25.00 mm (0.984 in)** |
|---|



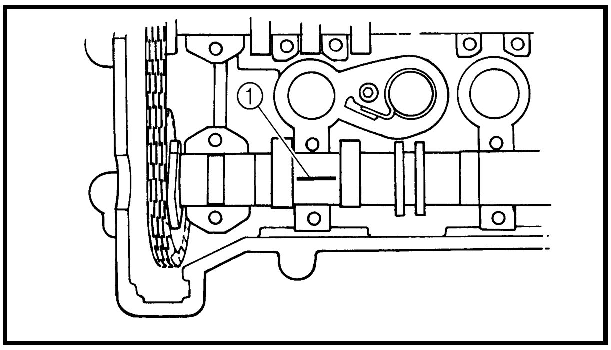
3. Measure:
   - Camshaft runout
     Out of specification → Replace.

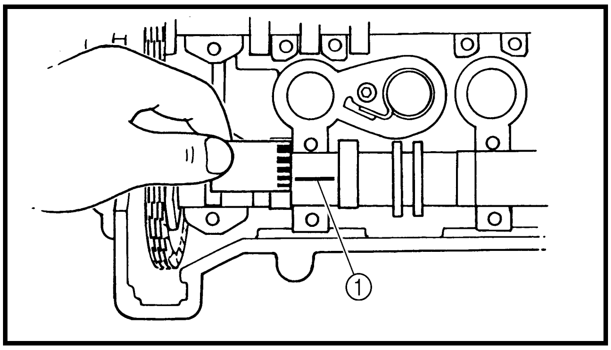
| | |
|---|---|
| | **Maximum camshaft runout:** <br> **0.03 mm (0.0012 in)** |




4. Measure:
   - Camshaft-journal-to-camshaft-cap clearance
     Out of specification → Measure the camshaft journal diameter.

| | |
|---|---|
| | **Camshaft-journal-to-camshaft-cap clearance:** <br> **0.05–0.06 mm (0.0020–0.0024 in)** |



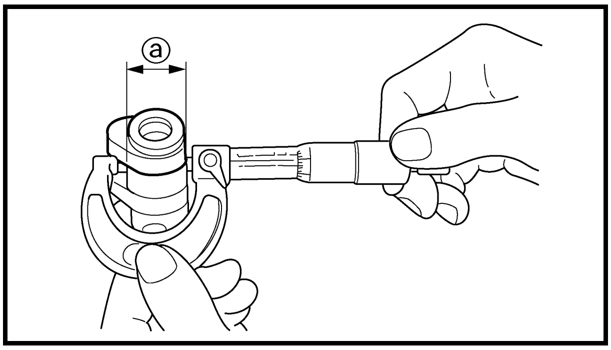




**Measurement steps:**
- Install the camshaft into the cylinder head (without the dowel pins and camshaft caps).
- Position a strip of Plastigauge ① onto the camshaft journal as shown.
- Install the dowel pins and camshaft caps.

**NOTE:**
- Tighten the intake and exhaust camshaft cap bolts in the sequence shown.
- Do not turn the camshaft when measuring the camshaft journal-to-camshaft cap clearance with the Plastigauge.

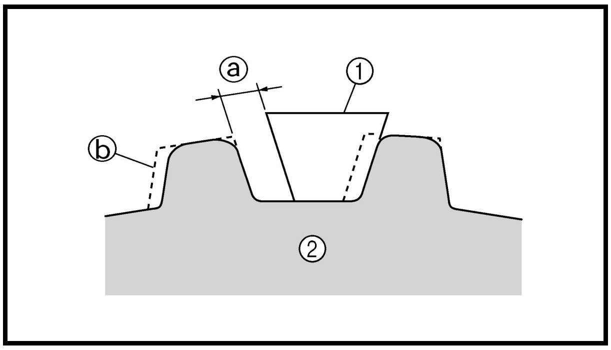
| | |
|---|---|
| | **Camshaft cap bolt:** <br> **10 N • m (1.0 kgf • m, 7.2 ft • lb)** |

- Remove the camshaft caps and then measure the width of the Plastigauge ①.




5. Measure:
   - Camshaft journal diameter ⓐ
     Out of specification → Replace the camshaft.
     Within specification → Replace the cylinder head and the camshaft caps as a set.

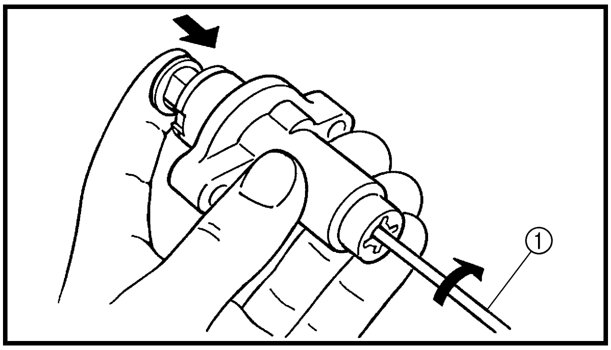
**Camshaft journal diameter:**
**Intake:**
**24.46–24.47 mm**
**(0.9630–0.9634 in)**
**Exhaust:**
**24.44–24.45 mm**
**(0.9622–0.9626 in)**

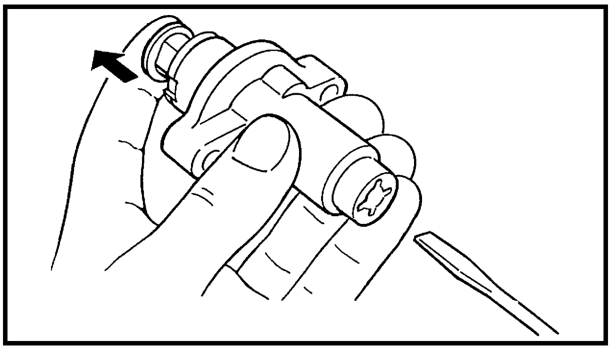



**Camshaft sprockets inspection**

1. Check:
   - Camshaft sprocket
     Wear/damage → Replace the camshaft sprockets and timing chain as a set.

ⓐ 1/4 of a tooth
ⓑ Correct
① Timing chain
② Camshaft sprocket

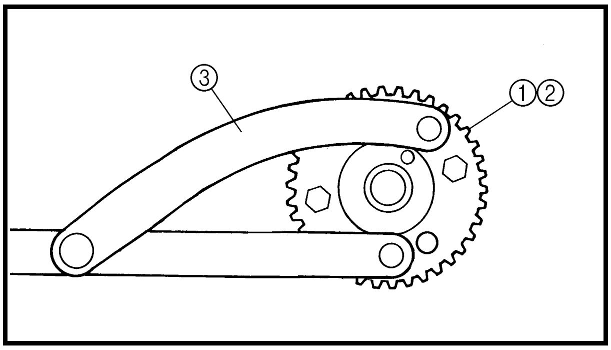


**Timing chain tensioner inspection**

1. Check:
   - Timing chain tensioner
     Cracks/damage/rough movement → Replace.

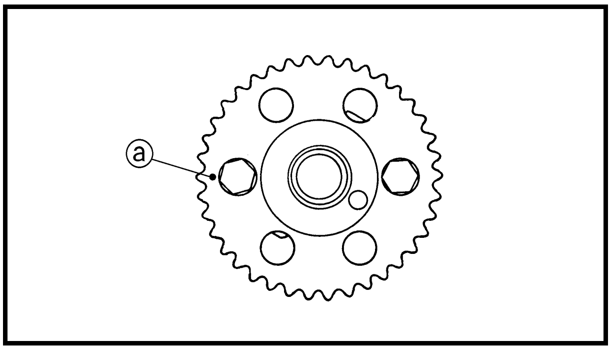
**Checking steps:**
- While lightly pressing the timing chain tensioner rod by hand, turn the tensioner rod fully clockwise with a thin screwdriver ①.
- Remove the screwdriver and slowly release the timing chain tensioner rod.
- Make sure that the timing chain tensioner rod comes out of the timing chain tensioner housing smoothly. If there is rough movement, replace the timing chain tensioner.




### Camshaft installation

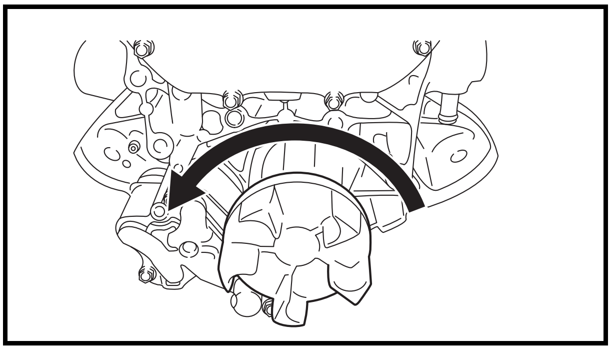
1. Install:
   - Exhaust camshaft sprocket ①
   - Intake camshaft sprocket ②
   (with the special service tool ③)

| | |
|---|---|
| | **Universal magneto and rotor holder:**<br>**YU-01235**<br>**Rotor holder:**<br>**90890-01235** |

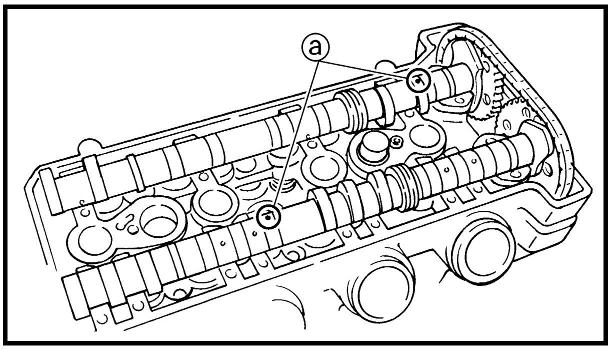



**NOTE:**
Install the camshaft sprocket with the punch mark ⓐ facing outside.

| | |
|---|---|
| | **Camshaft sprocket bolt:**<br>**24 N • m (2.4 kgf • m, 17 ft • lb)** |

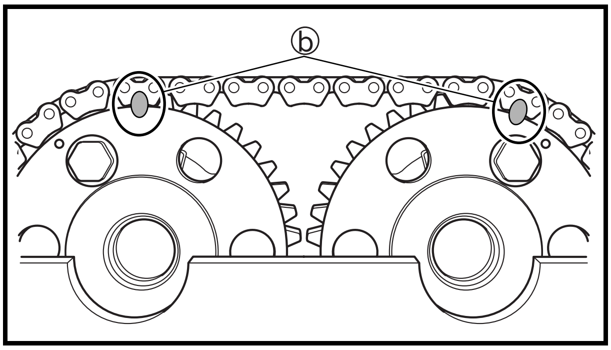


2. Install:
   - Exhaust camshaft
   - Intake camshaft
   - Exhaust camshaft caps
   - Intake camshaft caps

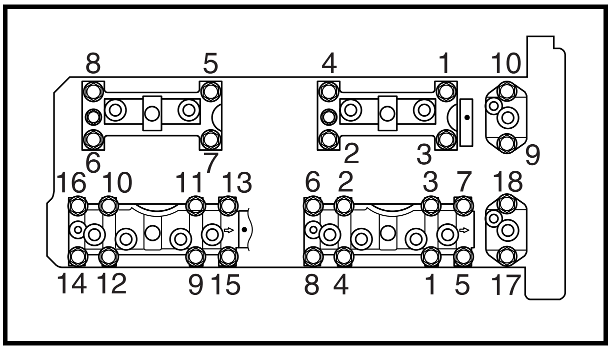



**Installation steps:**
- Turn the drive coupling counterclockwise, and then check if cylinder #1 is at TDC of the compression stroke with a dial gauge.
- Install the timing chain onto both camshaft sprockets, and then install the camshaft.

**CAUTION:**
**Do not turn the crankshaft when installing the camshaft to avoid damage or improper valve timing.**



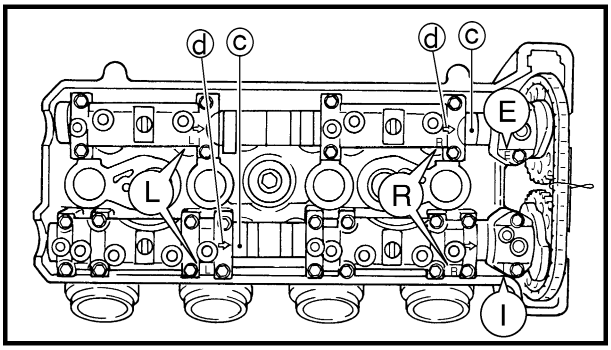

**NOTE:**
- Make sure that the punch marks ⓐ on the camshafts face up.
- Be sure to align the alignment marks ⓑ made during removal to install the timing chain and camshaft sprockets.




- Install the exhaust and intake camshaft caps.

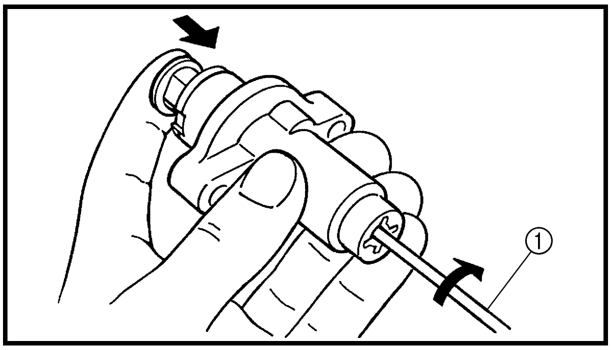
**NOTE:**
Gradually tighten the intake and exhaust camshaft cap bolts in 2–3 steps in the sequence shown.

**Camshaft cap bolt:**
**10 N • m (1.0 kgf • m, 7.2 ft • lb)**




**NOTE:**
Make sure that the punch marks ⓒ on the camshafts are aligned with the arrow marks ⓓ on the camshaft caps.
Out of alignment → Reinstall.

- Remove the wire from the timing chain.

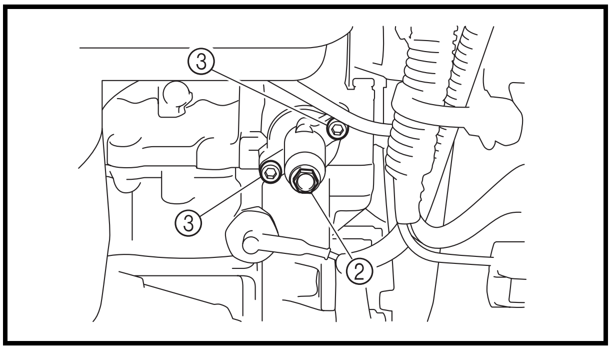



3. Install:
   - Timing chain tensioner

**Installation steps:**

- While lightly pressing the timing chain tensioner rod by hand, turn the tensioner rod fully clockwise with a thin screwdriver ①.

**NOTE:**
Make sure that the tensioner rod has been fully set clockwise.




- With the timing chain tensioner rod turned all the way into the timing chain tensioner housing (with the thin screw-driver still installed), install the gasket and the timing chain tensioner ② onto the cylinder block.

**⚠ WARNING**
**Always use a new gasket.**

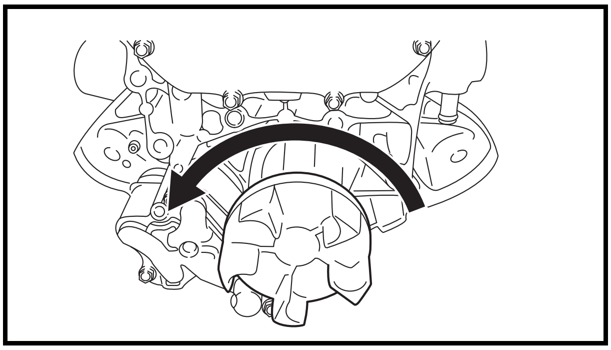
- Tighten the timing chain tensioner bolts ③ to the specified torque.

**NOTE:**
The “UP” mark on the timing chain tensioner should face up.

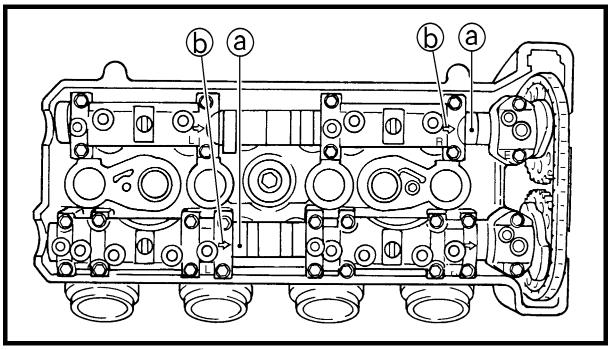
| | |
|---|---|
| | **Timing chain tensioner bolt:**<br>**10 N • m (1.0 kgf • m, 7.2 ft • lb)** |

- Remove the screwdriver, make sure the timing chain tensioner rod releases, and then tighten the cap bolt to the specified torque.

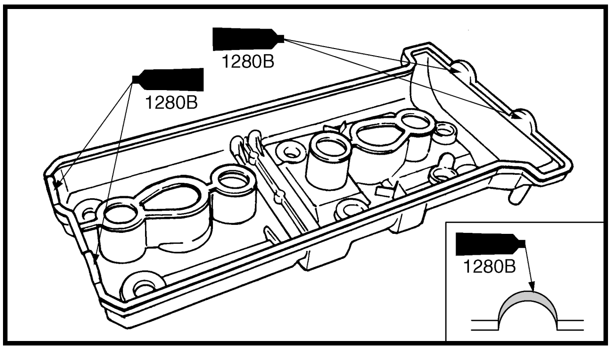
| | |
|---|---|
| | **Cap bolt:**<br>**10 N • m (1.0 kgf • m, 7.2 ft • lb)** |



4. Turn:
   - Drive coupling
     (several turns counterclockwise)




5. Check:
   Turn the drive coupling counterclockwise, and then check if cylinder #1 is at TDC of the compression stroke with a dial gauge.
   - Camshaft punch marks ⓐ
     Make sure that the camshaft punch marks are aligned with the arrow marks ⓑ on the camshaft caps.
     Out of alignment → Adjust.
     Refer to the installation steps above.
6. Measure:
   - Valve clearance
     Out of specification → Adjust.
     Refer to “POWER UNIT” in Chapter 3.

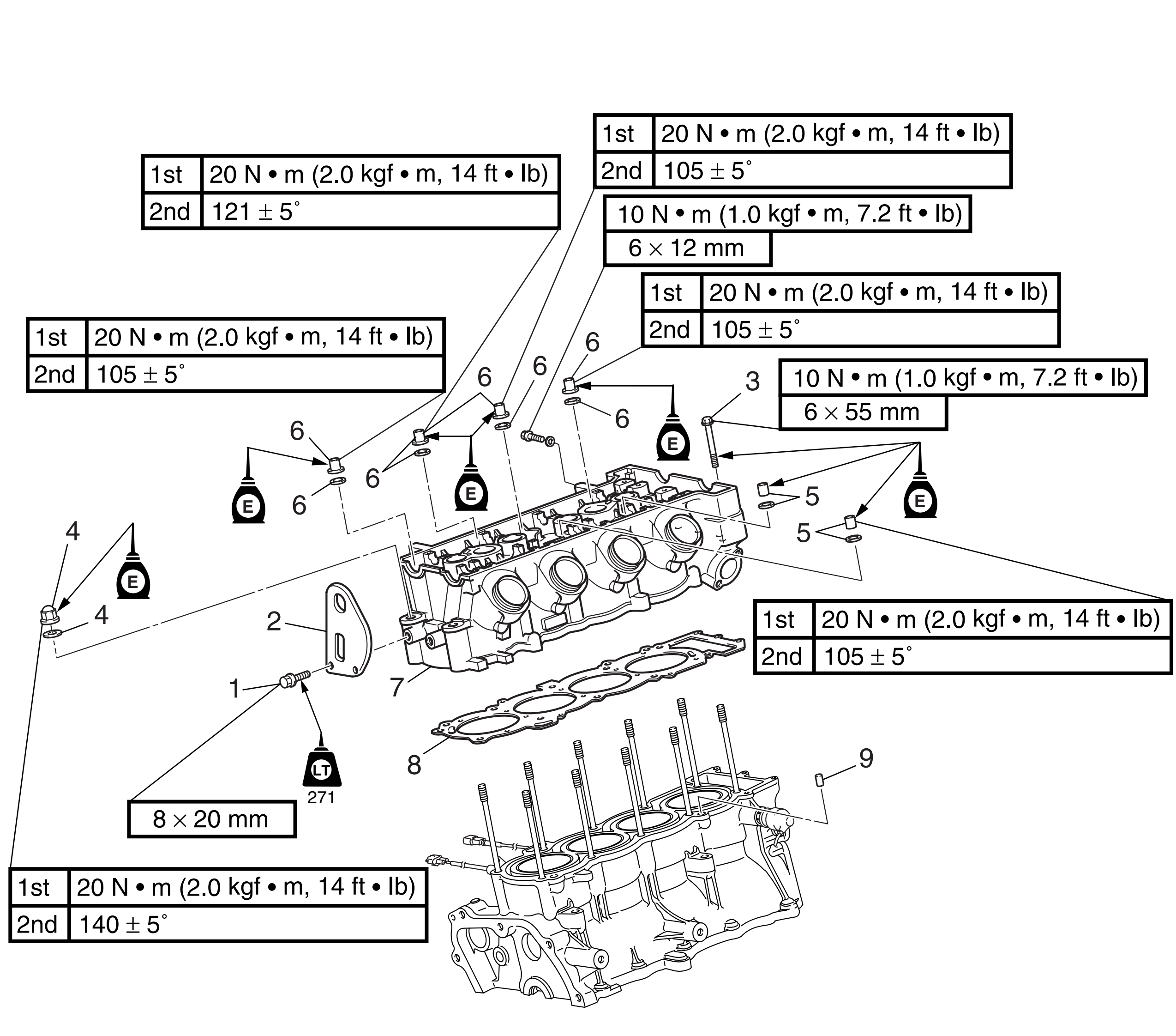



7. Install:
   - Cylinder head cover gasket
   - Cylinder head cover

**NOTE:**
- Apply sealant onto the mating surfaces of the cylinder head cover gasket and cylinder head.
- Tighten the cylinder head cover bolts stages and in a crisscross pattern.

**Cylinder head cover bolt:**
**12 N • m (1.2 kgf • m, 8.7 ft • lb)**

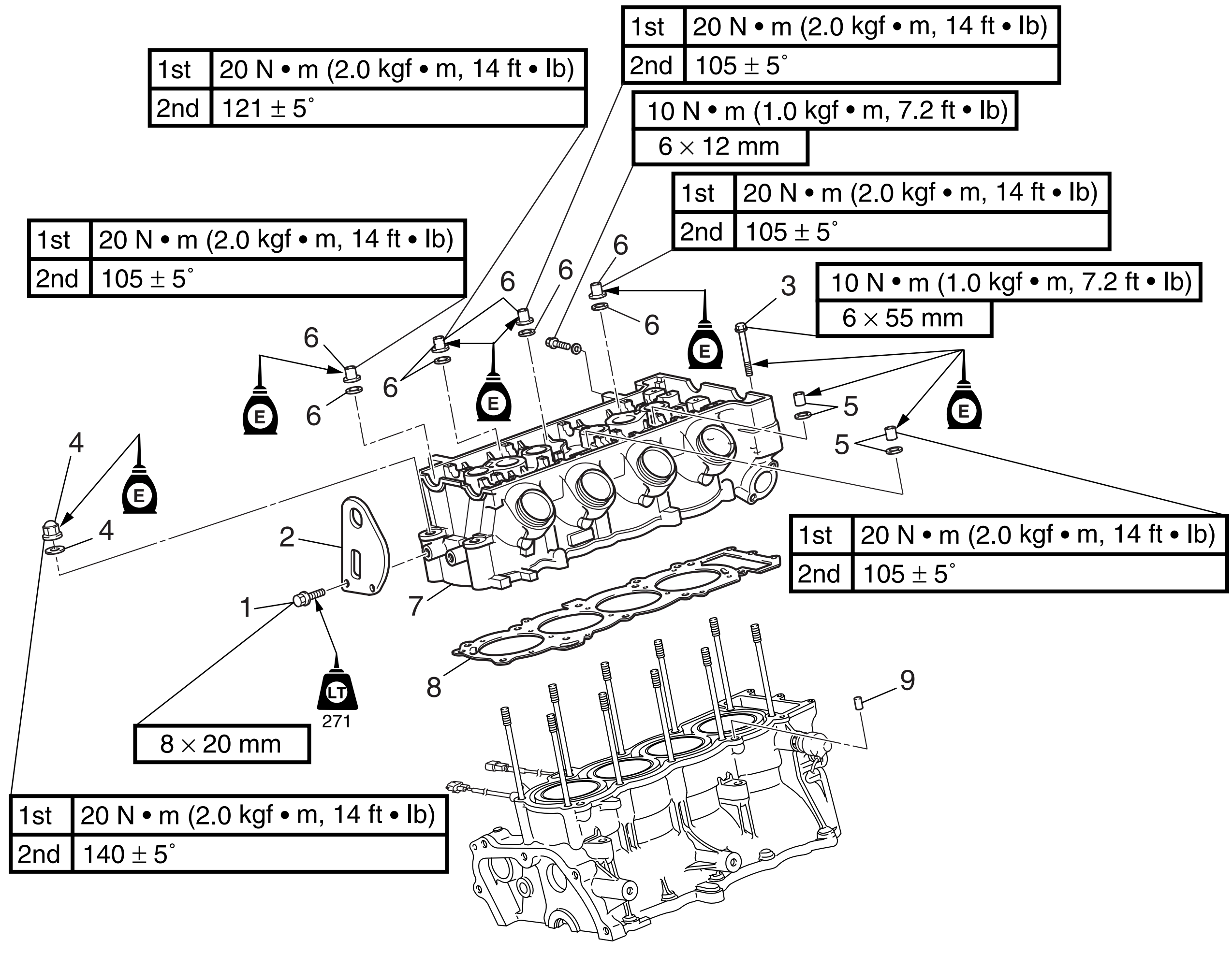
# CYLINDER HEAD
## EXPLODED DIAGRAM



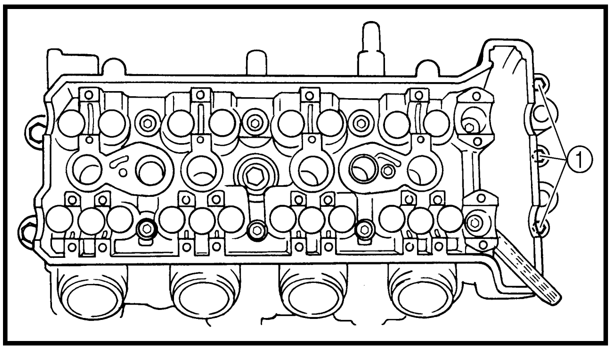

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **CYLINDER HEAD REMOVAL** | | Follow the left "Step" for removal. |
| | Engine unit | | Refer to "ENGINE UNIT". |
| | Intake assembly | | Refer to "FUEL INJECTION SYSTEM" in Chapter 4. |
| | Exhaust pipes 1 and 2 | | Refer to "EXHAUST PIPES 1 AND 2". |
| | Oil tank | | Refer to "OIL TANK". |
| | Intake and exhaust camshaft | | Refer to "CAMSHAFTS". |
| 1 | Bolt | 2 | |
| 2 | Hunger | 1 | |
| 3 | Bolt | 3 | |

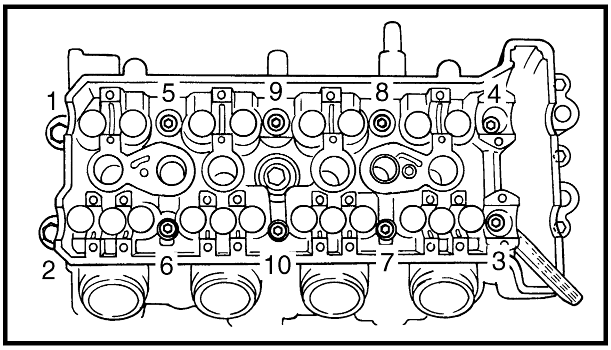
## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 4 | Nut/washer | 2/2 | |
| 5 | Nut/washer | 3/3 | |
| 6 | Nut/washer | 5/5 | |
| 7 | Cylinder head | 1 | |
| 8 | Cylinder head gasket | 1 | **Not reusable** |
| 9 | Dowel pin | 2 | |
| | | | Reverse the removal steps for installation. |




## SERVICE POINTS
### Cylinder head removal
1. Remove:
   - Cylinder head bolts ①



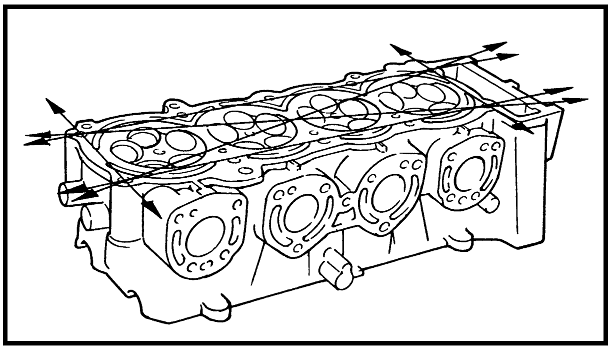

2. Remove:
   - Cylinder head nuts

**NOTE:**
Loosen the cylinder head nuts in the sequence shown.

### Cylinder head inspection
1. Eliminate:
   - Combustion chamber carbon deposits (with a rounded scraper)

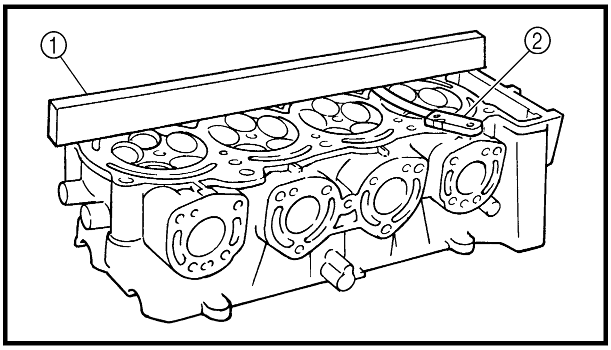
**NOTE:**
Do not use a sharp instrument to avoid damaging or scratching:
- spark plug bore threads
- valve seats

2. Check:
   - Cylinder head
     Damage/scratches → Replace.
   - Cylinder head water jacket
     Mineral deposits/rust → Eliminate.

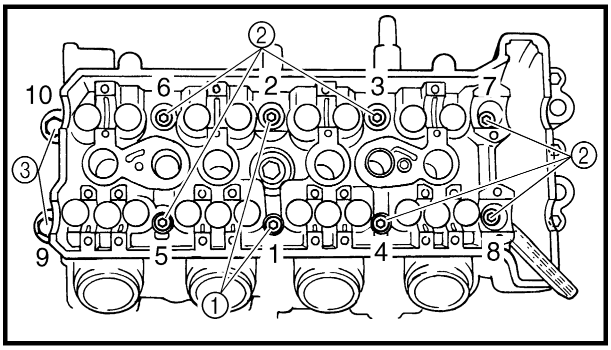


3. Measure:
   - Cylinder head warpage
     Out of specification → Replace the cylinder head.

**Cylinder head warpage limit:**
**0.1 mm (0.004 in)**




**Measurement steps:**
- Place a straightedge ① and a thickness gauge ② across the cylinder head.
- Measure the warpage.
- If the limit is exceeded, replace the cylinder head.

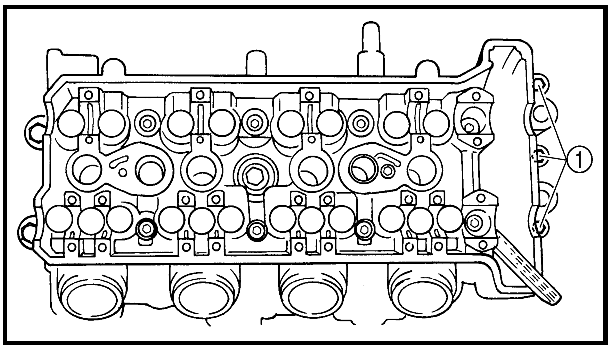



**Cylinder head installation**

1. Install:
   - Cylinder head

**NOTE:**
- Pass the timing chain through the timing chain cavity.
- Lubricate the cylinder head nuts with engine oil.
- Tighten the cylinder head nuts in the sequence shown.

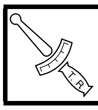
**Cylinder head nut ①:**
**1st:**
**20 N • m (2.0 kgf • m, 14 ft • lb)**
**2nd:**
**121 ± 5°**
**Cylinder head nut ②:**
**1st:**
**20 N • m (2.0 kgf • m, 14 ft • lb)**
**2nd:**
**105 ± 5°**
**Cylinder head nut ③:**
**1st:**
**20 N • m (2.0 kgf • m, 14 ft • lb)**
**2nd:**
**140 ± 5°**




2. Tighten:
   - Cylinder head bolts ①

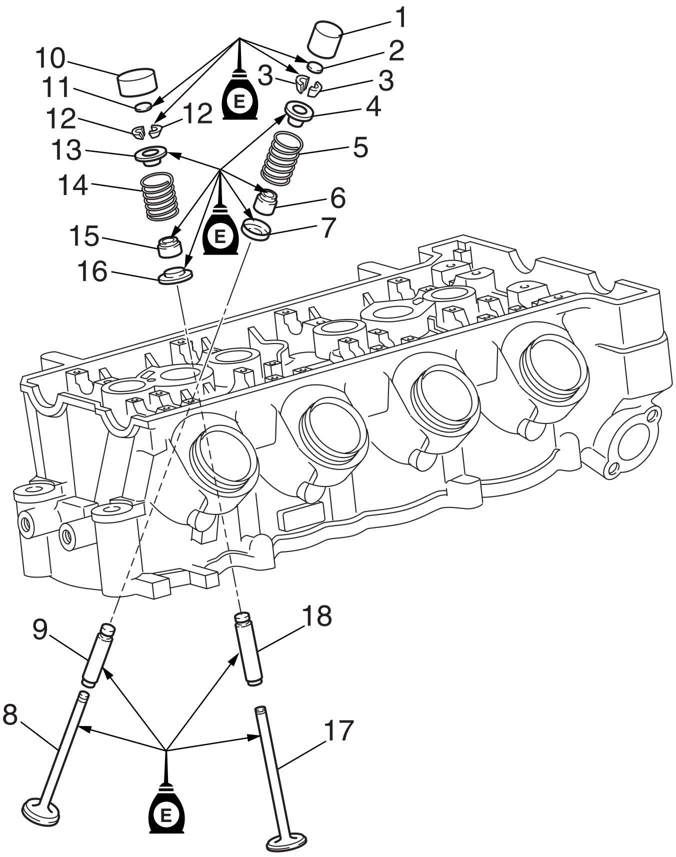
**NOTE:**

Lubricate the cylinder head bolts with engine oil.




**Cylinder head bolt:**
**10 N • m (1.0 kgf • m, 7.2 ft • lb)**

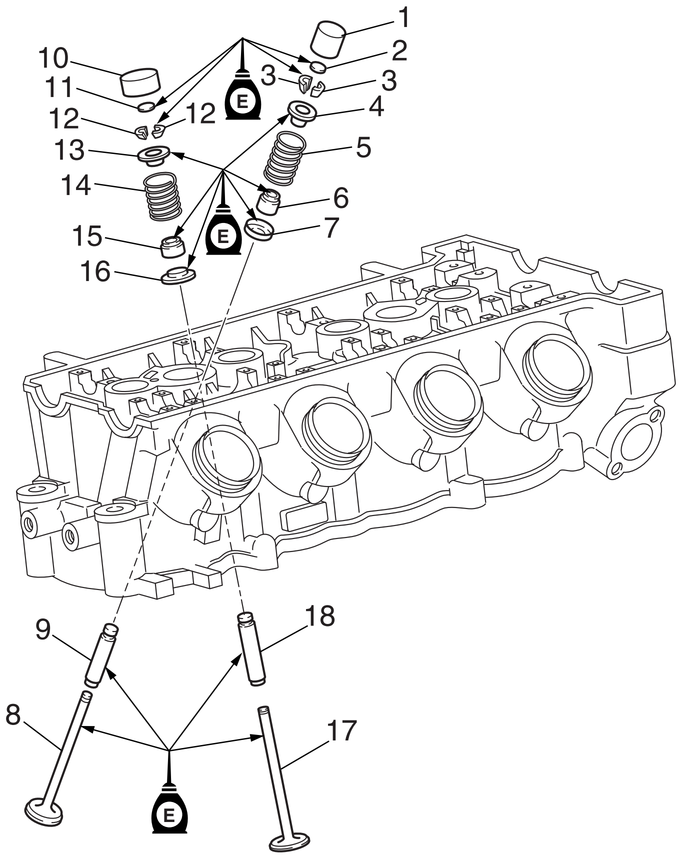
# VALVES AND VALVE SPRINGS
## EXPLODED DIAGRAM



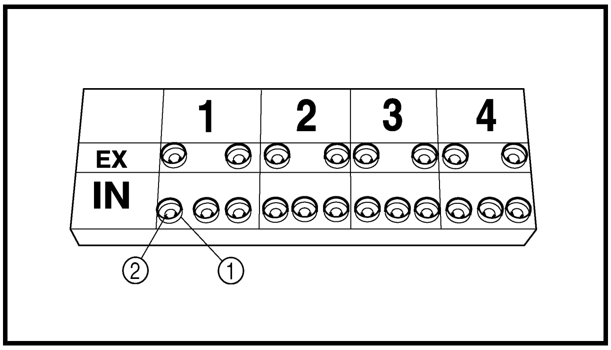

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **VALVES AND VALVE SPRINGS REMOVAL** | | Follow the left "Step" for removal. |
| | Cylinder head | | Refer to "CYLINDER HEAD". |
| 1 | Intake valve lifter | 12 | |
| 2 | Intake valve pad | 12 | |
| 3 | Intake valve cotter | 24 | |
| 4 | Intake valve upper spring seat | 12 | |
| 5 | Intake valve spring | 12 | |
| 6 | Intake valve stem seal | 12 | **Not reusable** |
| 7 | Intake valve lower spring seat | 12 | |
| 8 | Intake valve | 12 | |
| 9 | Intake valve guide | 12 | **Not reusable** |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 10 | Exhaust valve lifter | 8 | |
| 11 | Exhaust valve pad | 8 | |
| 12 | Exhaust valve cotter | 16 | |
| 13 | Exhaust valve upper spring seat | 8 | |
| 14 | Exhaust valve spring | 8 | |
| 15 | Exhaust valve stem seal | 8 | **Not reusable** |
| 16 | Exhaust valve lower spring seat | 8 | |
| 17 | Exhaust valve | 8 | |
| 18 | Exhaust valve guide | 8 | **Not reusable** |
| | | | Reverse the removal steps for installation. |

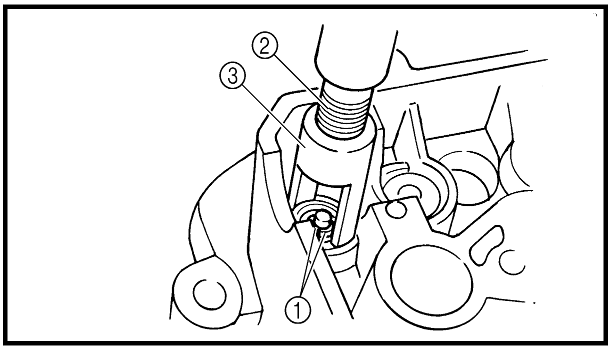



## SERVICE POINTS

### Valve removal

1. Remove:
   - Valve lifter ①
   - Valve pad ②

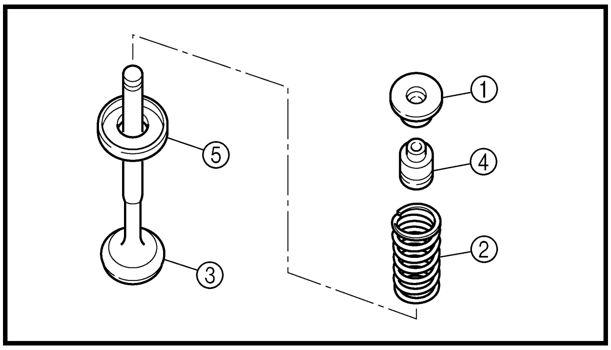
**NOTE:**
Make a note of the position of each valve lifter and valve pad so that they can be reinstalled in their original place.




2. Remove:
   - Valve cotters ①

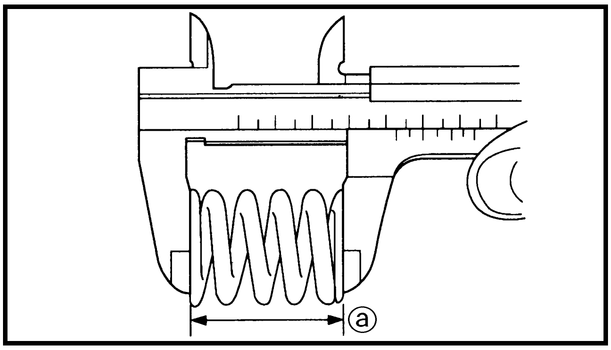
**NOTE:**
Remove the valve cotters by compressing the valve spring with the valve spring compressor ② and attachment ③.

**Valve spring compressor:**
**YM-01253/90890-04019**
**Valve spring compressor attachment:**
**(for the intake valve):**
**YM-04114/90890-04114**
**(for the exhaust valve):**
**YM-04108/90890-04108**




3. Remove:
   - Upper spring seat ①
   - Valve spring ②
   - Valve ③
   - Stem seal ④
   - Lower spring seat ⑤

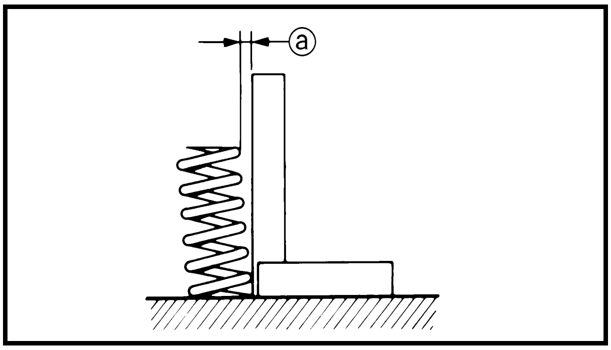
**NOTE:**
Identify the position of each part very carefully so that it can be reinstalled in its original place.




**Valve spring inspection**

1. Measure:
   - Valve spring free length ⓐ
     Out of specification → Replace the valve spring.

**Valve spring free length:**
**Intake valve spring:**
**38.90 mm (1.53 in)**
**Exhaust valve spring:**
**40.67 mm (1.60 in)**

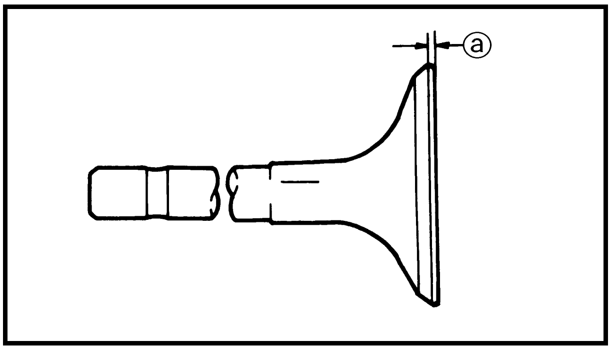



2. Measure:
   - Valve spring tilt ⓐ
     Out of specification → Replace the valve spring.

**Valve spring tilt limit:**
**Intake valve spring:**
**2.5°/1.7 mm (0.067 in)**
**Exhaust valve spring:**
**2.5°/1.8 mm (0.071 in)**

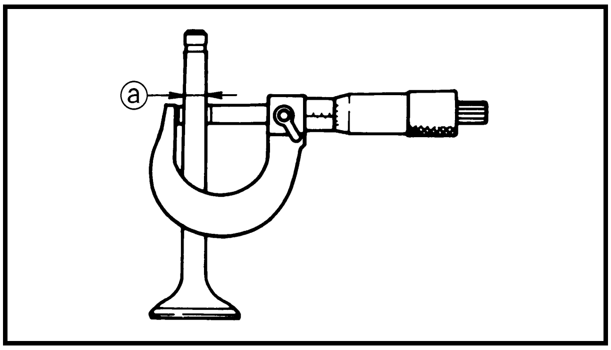
**Valve inspection**

1. Eliminate:
   - Carbon deposits
     (from the valve face and valve seat)
2. Check:
   - Valve face
     Pitting/wear → Replace the valve.



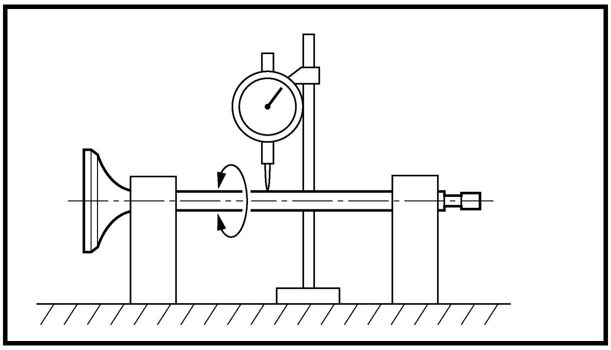

3. Measure:
   - Valve margin thickness ⓐ
     Out of specification → Replace the valve.

**Valve margin thickness:**
**0.85–1.15 mm (0.0335–0.0453 in)**




4. Measure:
   - Valve stem diameter ⓐ
     Out of specification → Replace the valve.

**Valve stem diameter ⓐ:**
**Intake valve:**
**3.975–3.990 mm**
**(0.1565–0.1571 in)**
**Exhaust valve:**
**4.465–4.480 mm**
**(0.1758–0.1764 in)**



5. Measure:
   - Valve stem runout
     Out of specification → Replace the valve.

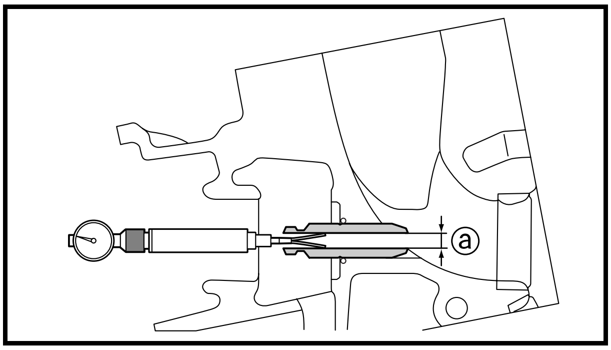
**NOTE:**
- When installing a new valve, always replace the valve guide.
- If the valve is removed or replaced, always replace the stem seal.

**Valve stem runout:**
**0.01 mm (0.0004 in)**

### Valve guide inspection

**NOTE:**

Before checking the valve guide make sure that the valve stem diameter is within specification.



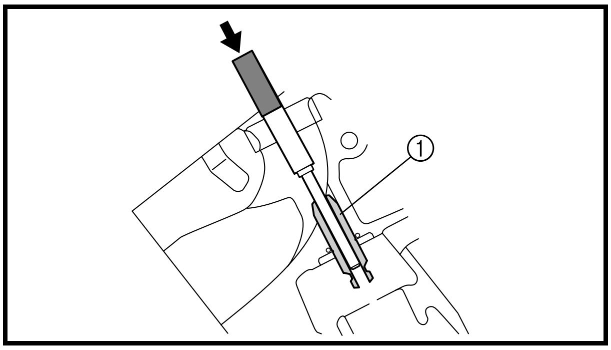

1. Measure:
   - Valve guide inside diameter ⓐ

> **Valve guide inside diameter:**
> **Intake:**
> **4.000–4.012 mm**
> **(0.1575–0.1580 in)**
> **Exhaust:**
> **4.500–4.512 mm**
> **(0.1772–0.1776 in)**

2. Calculate the valve stem-to-valve guide clearance as follows. Replace the valve guide if out of specification.

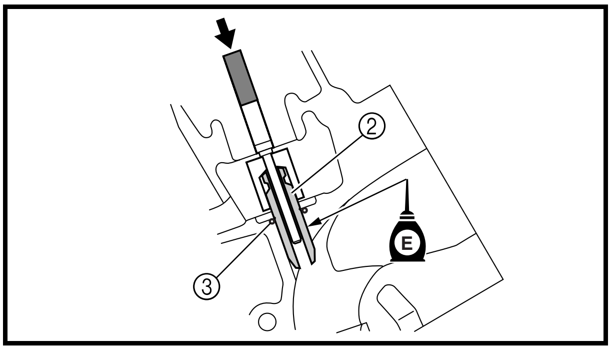
> **Valve stem-to-valve guide clearance = valve guide inside diameter – valve stem diameter:**
> **Intake:**
> **0.010–0.037 mm**
> **(0.0004–0.0015 in)**
> **Exhaust:**
> **0.020–0.047 mm**
> **(0.0008–0.0019 in)**

### Valve guide replacement



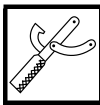

1. Remove the valve guide ① by striking the special service tool from the combustion chamber side.

> **Valve guide remover:**
> **Intake (ø4.0 mm):**
> **YM-04111/90890-04111**
> **Exhaust (ø4.5 mm):**
> **YM-04116/90890-04116**

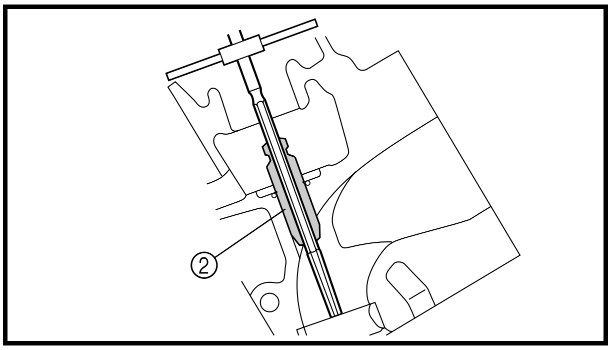



2. Install the new valve guide ② by striking the special service tool from the camshaft side until the valve guide clip ③ contacts the cylinder head.

**NOTE:**
Apply engine oil to the surface of the new valve guide.

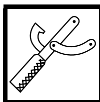


**Valve guide remover:**
**Intake (ø4.0 mm):**
**YM-04111/90890-04111**
**Exhaust (ø4.5 mm):**
**YM-04116/90890-04116**
**Valve guide installer:**
**Intake (ø4.0 mm):**
**YM-04112/90890-04112**
**Exhaust (ø4.5 mm):**
**YM-04117/90890-04117**



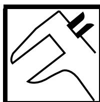

3. Insert the special service tool into the valve guide ②, and then ream the valve guide.

**NOTE:**
- Turn the valve guide reamer clockwise to ream the valve guide.
- Do not turn the reamer counterclockwise when removing the reamer.



**Valve guide reamer:**
**Intake (ø4.0 mm):**
**YM-04113/90890-04113**
**Exhaust (ø4.5 mm):**
**YM-04118/90890-04118**

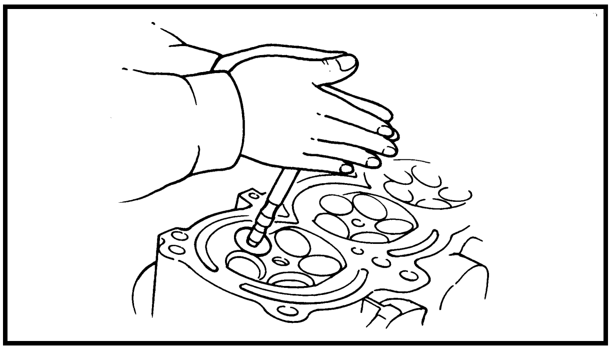
4. Measure:
   - Valve guide inside diameter



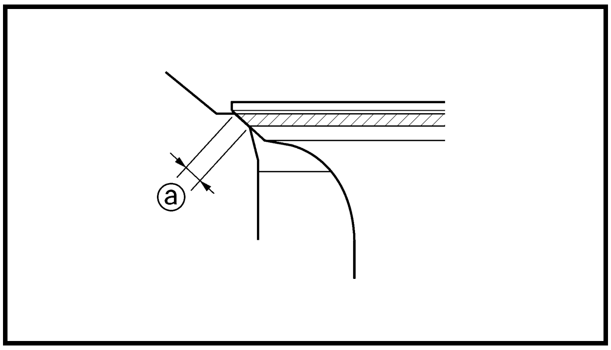
**Valve guide inside diameter:**
**Intake:**
**4.000–4.012 mm**
**(0.1575–0.1580 in)**
**Exhaust:**
**4.500–4.512 mm**
**(0.1772–0.1776 in)**

**Valve seat inspection**

1. Eliminate carbon deposits from the valve with a scraper.
2. Apply a thin, even layer of Mechanic's blueing dye (Dykem) onto the valve seat.

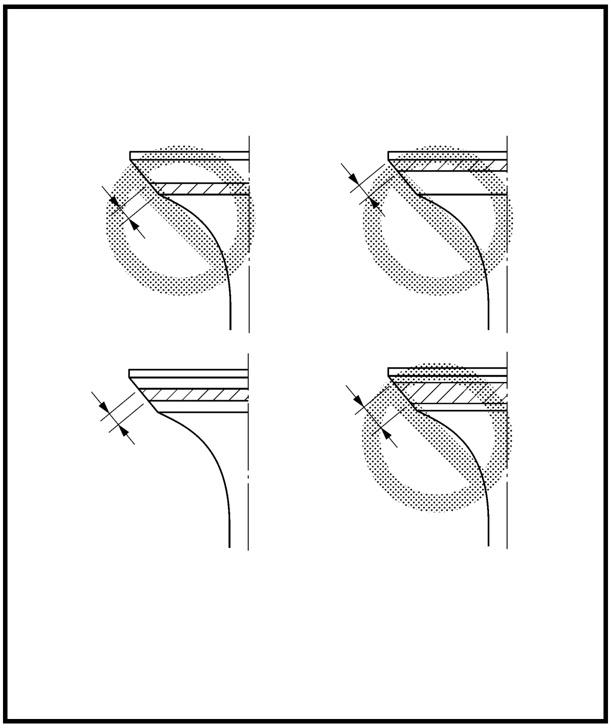


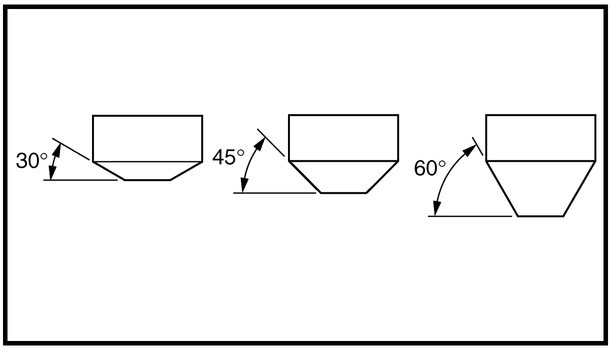
3. Lap the valve slowly on the valve seat with a valve lapper (commercially available) as shown.




4. Measure the valve seat contact width ⓐ where the blueing dye is adhered to the valve face. Reface the valve seat if the valve is not seated properly or if the valve seat contact width is out of specification. Replace the valve guide if the valve seat contact is uneven.

| | Valve seat contact width ⓐ:<br>0.90–1.10 mm (0.0354–0.0433 in) |
|---|---|

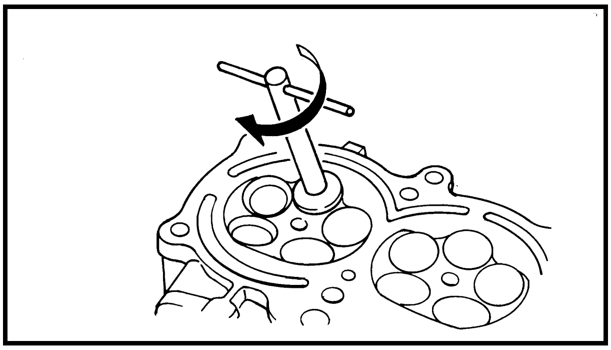


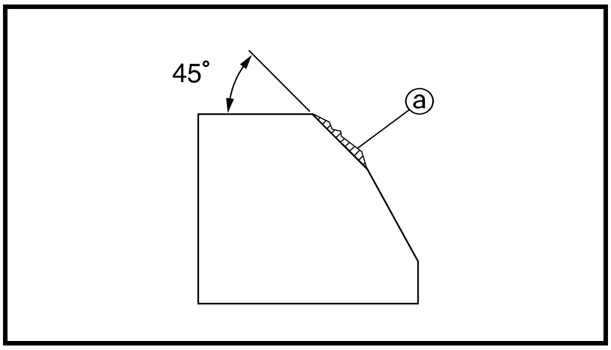



**Valve seat reface**

1. Reface the valve seat with the valve seat cutter.

**Valve seat cutter holder:**
**Intake (ø4.0 mm):**
**90890-06811**
**Exhaust (ø4.5 mm):**
**90890-06812**
**Valve seat cutter:**
**30° (intake):**
**90890-06815**
**45° (intake):**
**90890-06814**
**60° (intake):**
**90890-06813**
**30° (exhaust):**
**90890-06328**
**45° (exhaust):**
**90890-06312**
**60° (exhaust):**
**90890-06315**
**Neway valve seat cutter kit:**
**YM-91044**



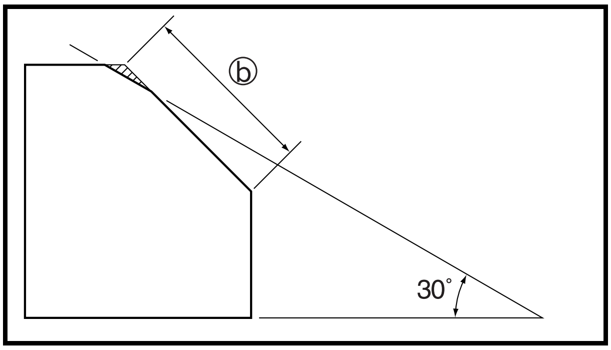



2. Cut the surface of the valve seat with a 45° cutter by turning the cutter clockwise until the valve seat face has become smooth.

ⓐ Slag or rough surface

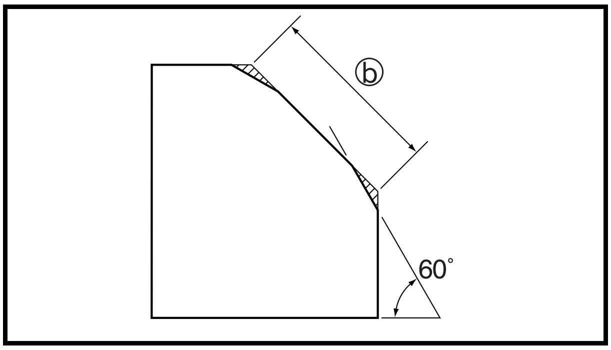
**CAUTION:**

**Do not over cut the valve seat. Be sure to turn the cutter evenly downward at a pressure of 40–50 N (4–5 kgf, 8.8–11 lbf) to prevent chatter marks.**



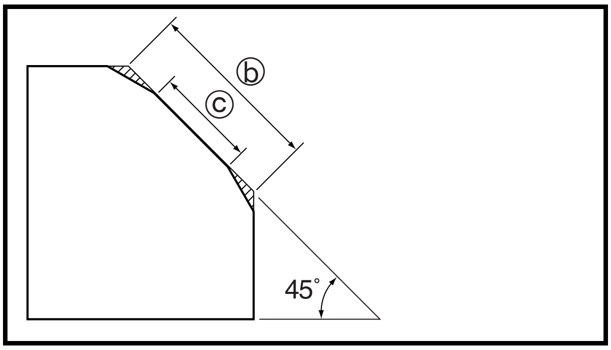

3. Use a 30° cutter to adjust the contact width of the top edge of the valve seat.

ⓑ Previous contact width



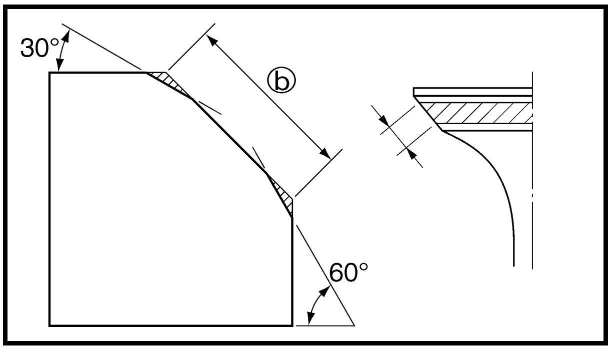

4. Use a 60° cutter to adjust the contact width of the bottom edge of the valve seat.

ⓑ Previous contact width



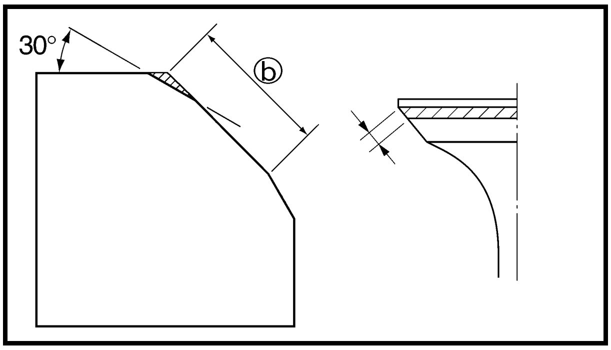

5. Use a 45° cutter to adjust the contact width of the valve seat to specification.

ⓑ Previous contact width
ⓒ Specified contact width



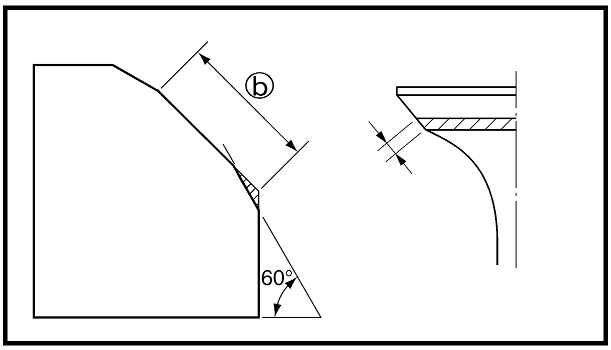

6. If the valve seat contact area is too wide and situated in the center of the valve face, use a 30° cutter to cut the top edge of the valve seat, a 60° cutter to cut the bottom edge to center the area and set its width.

ⓑ Previous contact width



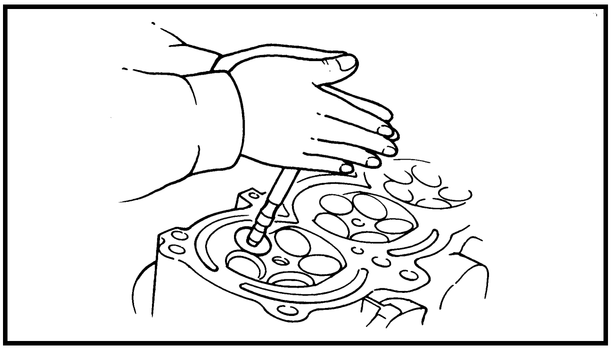

7. If the valve seat contact area is too narrow and situated near the top edge of the valve face, use a 30° cutter to cut the top edge of the valve seat. If necessary, use a 45° cutter to center the area and set its width.

ⓑ Previous contact width




8. If the valve seat contact area is too narrow and situated near the bottom edge of the valve face, use a 60° cutter to cut the bottom edge of the valve seat. If necessary, use a 45° cutter to center the area and set its width.

ⓑ Previous contact width

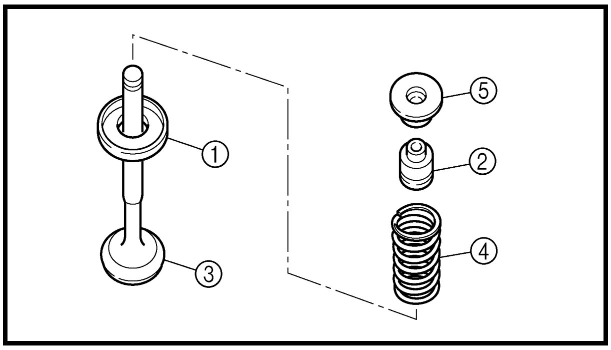


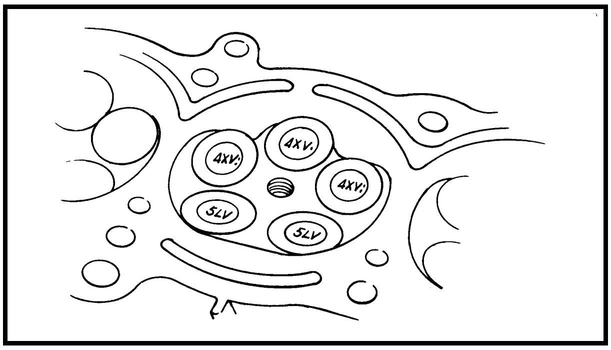
9. Apply a thin, even layer of lapping compound onto the valve seat, and then lap the valve using a valve lapper (commercially available).

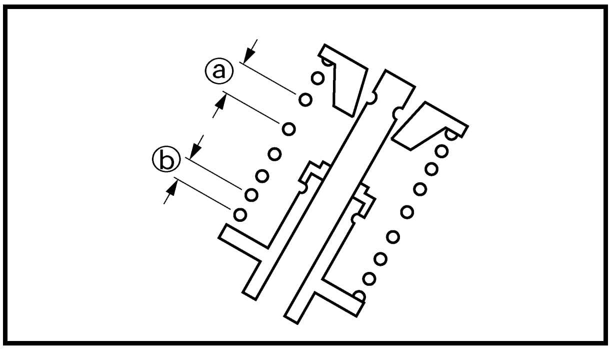
**CAUTION:**

**Do not get the lapping compound on the valve stem and valve guide.**

10. After every lapping procedure, be sure to clean off any remaining lapping compound from the cylinder head and the valve.
11. Check the valve seat contact area of the valve again.



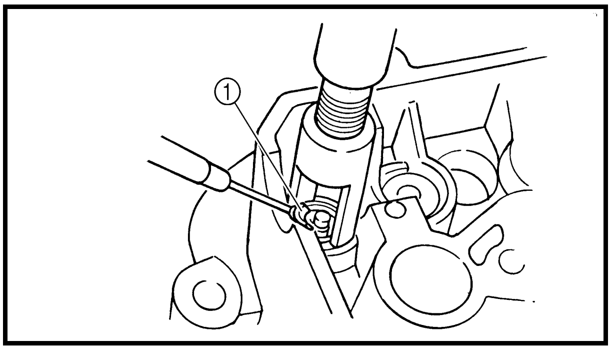

**Valve installation**

1. Install:
   - Lower spring seat ①
   - Stem seal ②
   - Valve ③
   - Valve spring ④
   - Upper spring seat ⑤
     (into the cylinder head)

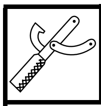
**NOTE:**

- Make sure that each valve is installed in its original place. Refer to the following embossed marks.
  Right and left intake valve(s): “4XV:”
  Middle intake valve(s): “4XV.”
  Exhaust valve(s): “5LV”
- Install the valve spring with the larger pitch ⓐ facing up.

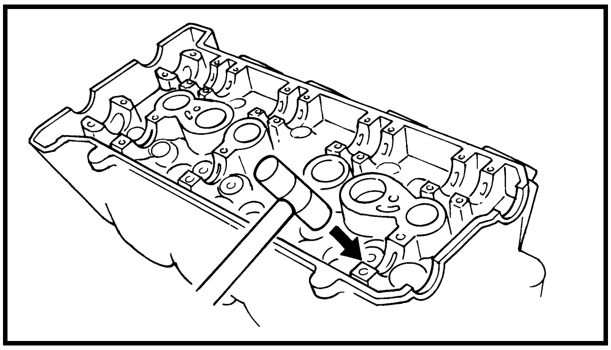
ⓑ Smaller pitch




2. Compress the valve spring, and then install the valve cotter ① using a thin screwdriver with a small amount of grease applied to it.



**Valve spring compressor:**
**YM-01253/90890-04019**
**Valve spring compressor attachment:**
**(for the intake valve):**
**YM-04114/90890-04114**
**(for the exhaust valve):**
**YM-04108/90890-04108**

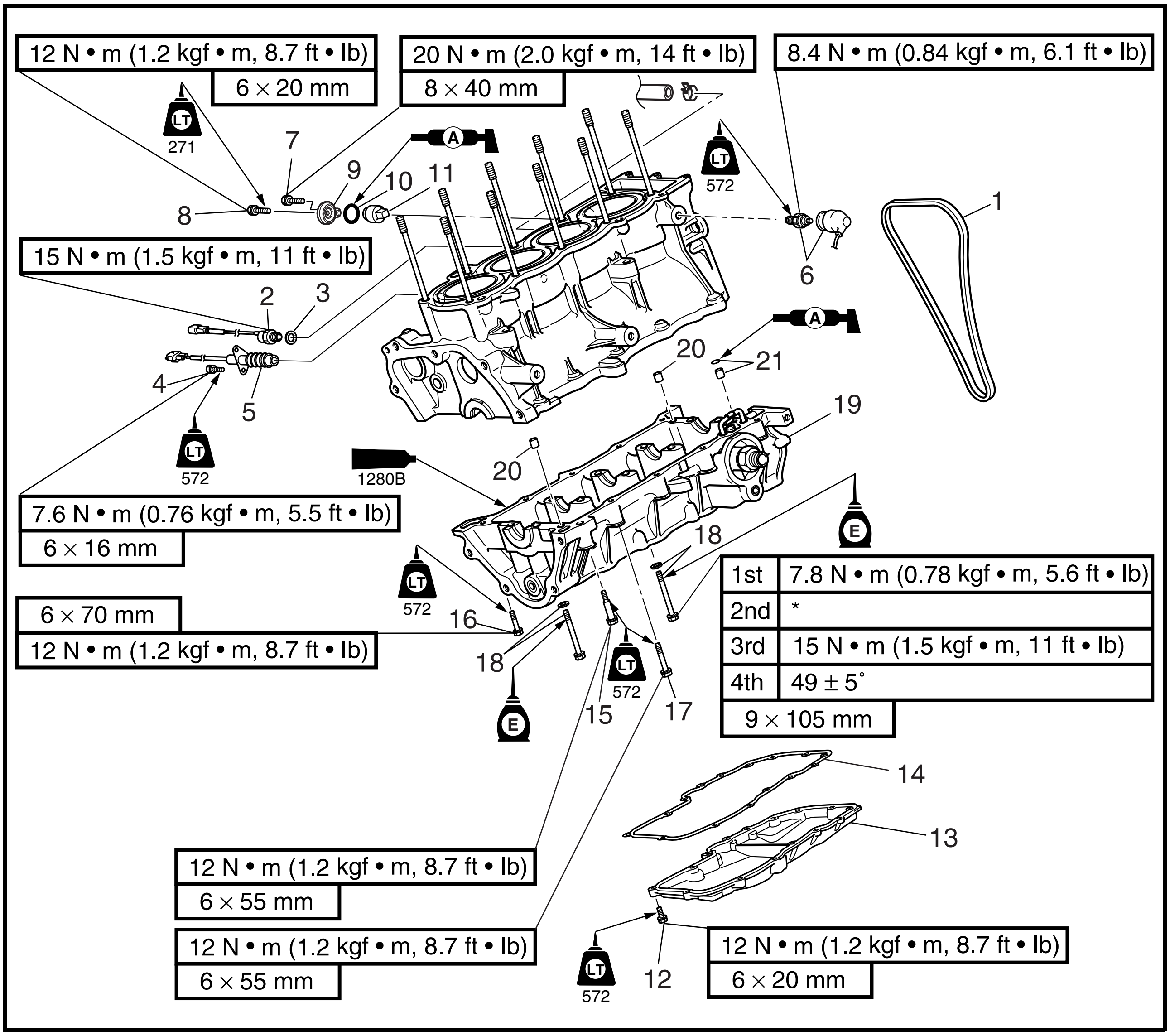


3. Lightly tap the valve spring retainer with a plastic hammer to set the valve cotter securely.

**NOTE:**
Apply engine oil to the valve pads and valve lifters before installation.

# CRANKCASE

## EXPLODED DIAGRAM

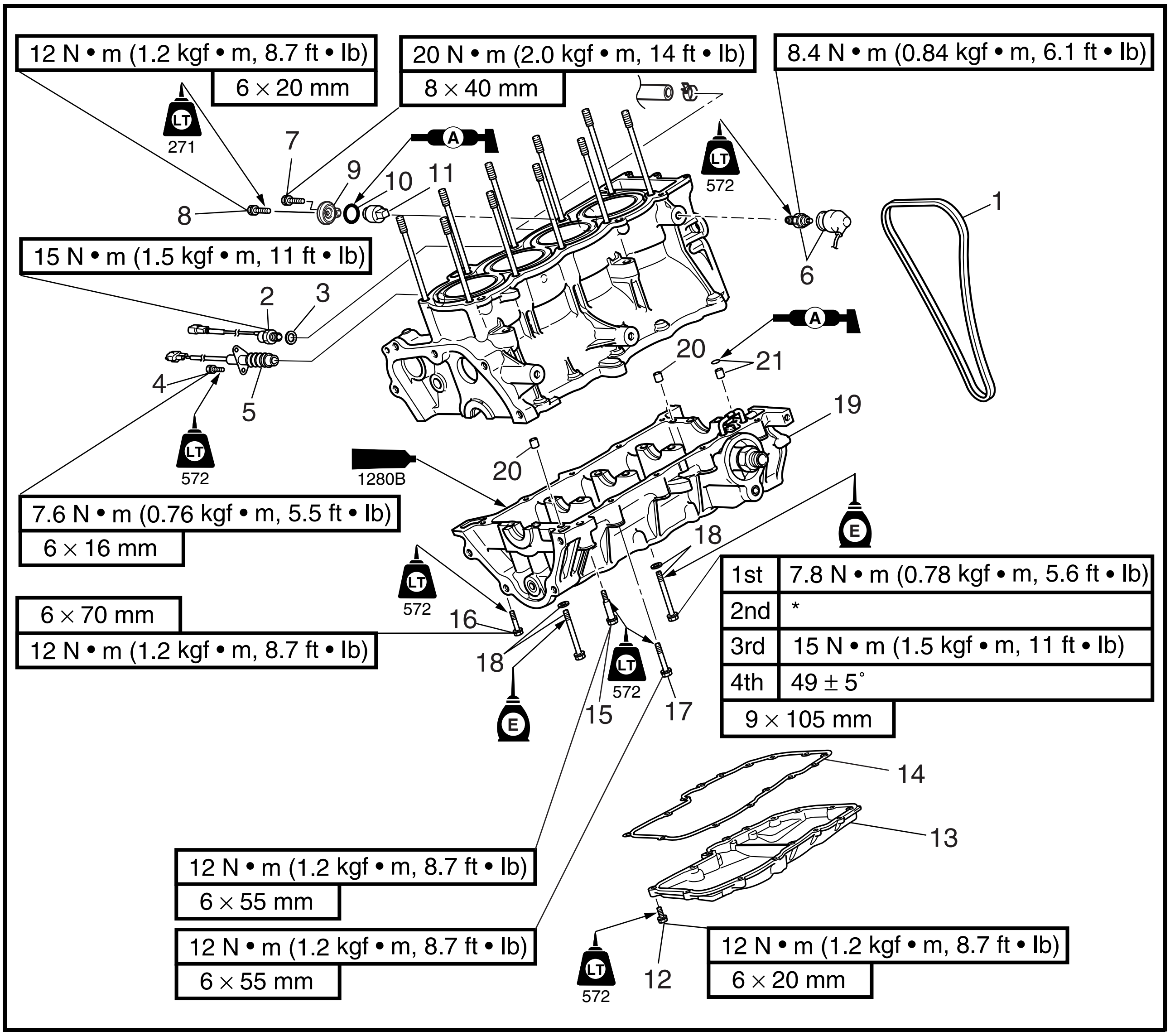



## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **OIL PAN AND CRANKCASE REMOVAL** | | Follow the left "Step" for removal. |
| | Engine unit | | Refer to "ENGINE UNIT". |
| | Intake assembly | | Refer to "FUEL INJECTION SYSTEM" in Chapter 4. |
| | Exhaust pipes 1 and 2 | | Refer to "EXHAUST PIPES 1 AND 2". |
| | Exhaust manifold | | Refer to "EXHAUST MANIFOLD". |
| | Generator cover | | Refer to "GENERATOR AND STARTER MOTOR". |
| | Oil tank | | Refer to "OIL TANK". |
| | Oil pump | | Refer to "OIL PUMP". |

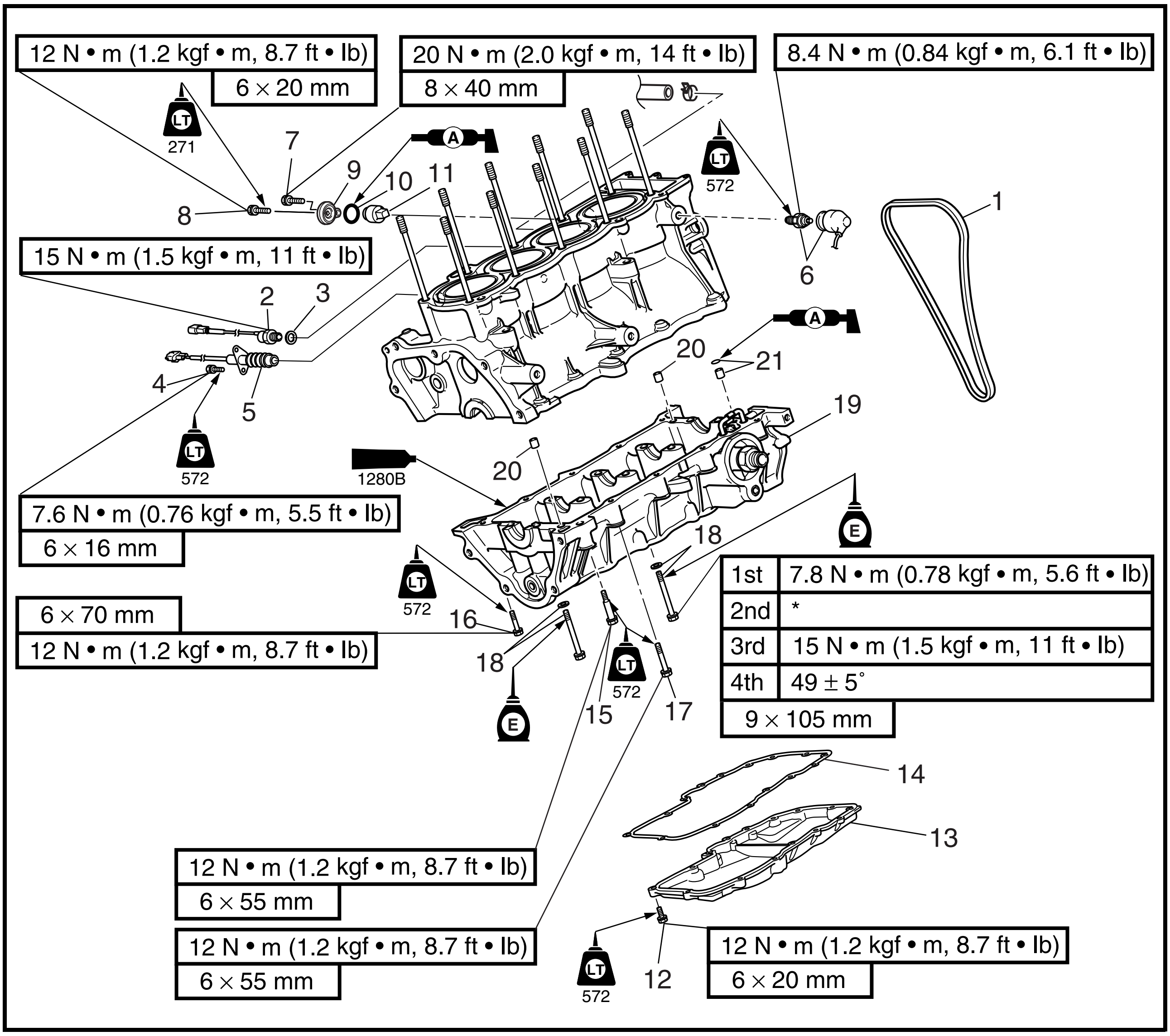
*: Loosen completely

## EXPLODED DIAGRAM



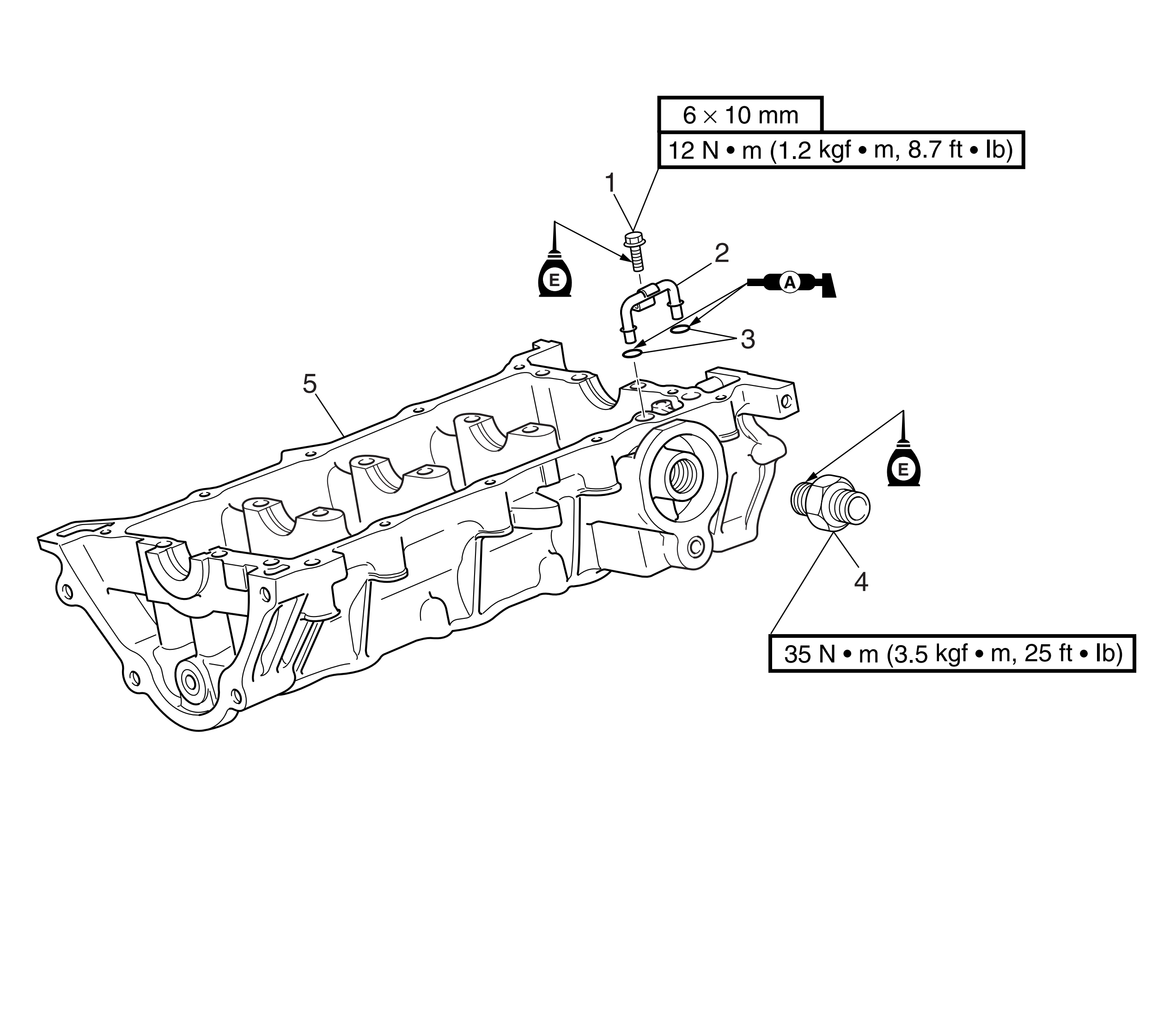

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | Reduction drive gear case | | Refer to "REDUCTION DRIVE GEAR". |
| | Cylinder head | | Refer to "CAMSHAFTS". |
| 1 | Timing chain | 1 | |
| 2 | Engine temperature sensor | 1 | |
| 3 | Washer | 1 | |
| 4 | Bolt | 2 | |
| 5 | Thermoswitch (engine) | 1 | |
| 6 | Oil pressure switch | 1 | |
| 7 | Bolt | 1 | |
| 8 | Bolt | 1 | |
| 9 | Anode cover | 1 | |
| 10 | Grommet | 1 | |

## EXPLODED DIAGRAM



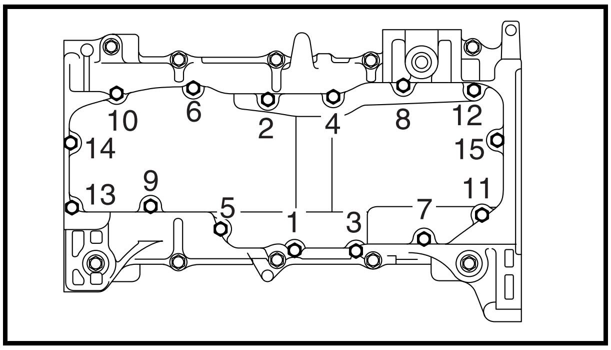

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 11 | Anode | 1 | |
| 12 | Bolt | 15 | |
| 13 | Oil pan | 1 | |
| 14 | Gasket | 1 | **Not reusable** |
| 15 | Bolt | 2 | |
| 16 | Bolt | 1 | |
| 17 | Bolt | 7 | |
| 18 | Bolt/washer | 10/10 | **Not reusable** |
| 19 | Lower crankcase | 1 | |
| 20 | Dowel pin | 2 | |
| 21 | Dowel pin/O-ring | 1/1 | **Not reusable** |
| | | | Reverse the removal steps for installation. |

## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q’ty | Service points |
|---|---|---|---|
| | **OIL PIPE AND OIL FILTER BOLT REMOVAL** | | Follow the left “Step” for removal. |
| | Crankshaft | | Refer to “CRANKSHAFT”. |
| 1 | Bolt | 1 | |
| 2 | Oil pipe | 1 | |
| 3 | O-ring | 2 | **Not reusable** |
| 4 | Oil filter bolt | 1 | |
| 5 | Lower crankcase | 1 | |
| | | | Reverse the removal steps for installation. |

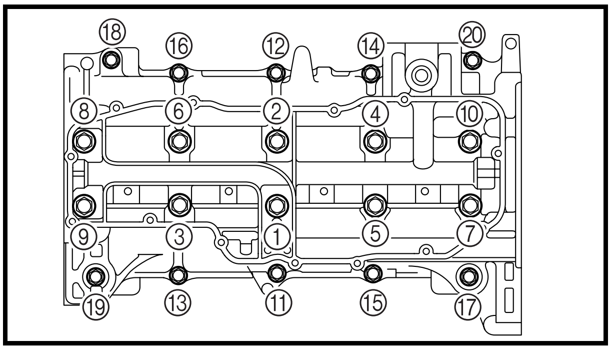



## SERVICE POINTS

### Crankcase disassembly

1. Remove:
   - Oil pan bolts

**NOTE:**
- Loosen each bolt 1/4 of a turn at a time, in stages and in a crisscross pattern. After all of the bolts are fully loosened, remove them.
- Loosen the bolts in decreasing numerical order (refer to the numbers in the illustration).
- The numbers embossed on the oil pan indicate the oil pan tightening sequence.




2. Remove:
   - Crankcase bolts

**NOTE:**
- Loosen each bolt 1/4 of a turn at a time, in stages and in a crisscross pattern. After all of the bolts are fully loosened, remove them.
- Loosen the bolts in decreasing numerical order (refer to the numbers in the illustration).
- The numbers embossed on the crankcase indicate the crankcase tightening sequence.

3. Remove:
   - Lower crankcase

**CAUTION:**

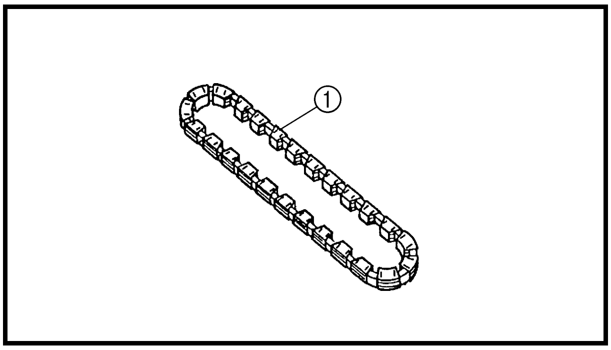
**Tap on one side of the crankcase with a soft-face hammer. Tap only on reinforced portions of the crankcase, not on the crankcase mating surfaces. Work slowly and carefully and make sure the crankcase halves separate evenly.**

M9 × 105 mm bolts: ①–⑩
M6 × 55 mm bolts: ⑪–⑱, ⑳
M6 × 70 mm bolts: ⑲

4. Remove:
   - Dowel pins

**Crankcase inspection**

1. Thoroughly wash the crankcase halves in a mild solvent.
2. Thoroughly clean all the gasket surfaces and crankcase mating surfaces.
3. Check:
   - Crankcase
     Cracks/damage → Replace.
   - Oil delivery passages
     Obstruction → Blow out with compressed air.




**Timing chain inspection**

1. Check:
   - Timing chain ①
     Damage/stiffness → Replace the timing chain and camshaft sprockets as a set.

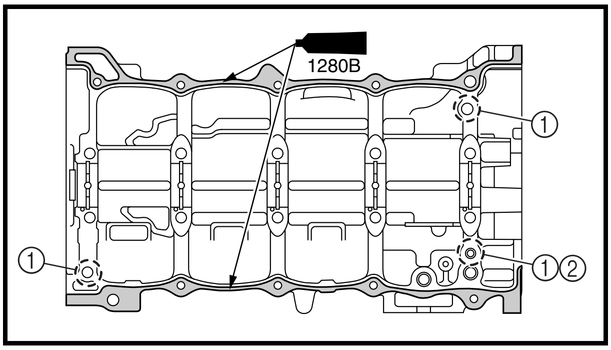
**Crankcase assembly**

1. Lubricate:
   Crankshaft journal bearings
   (with the recommended lubricant)

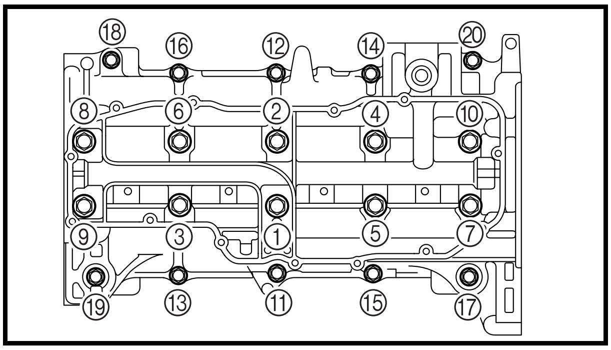
| **Recommended lubricant:** **Engine oil** |
|---|

2. Apply:
   - ThreeBond 1280B
     (onto the crankcase mating surfaces)

**NOTE:**
Do not allow any sealant to come into contact with the oil gallery or crankshaft journal bearings.



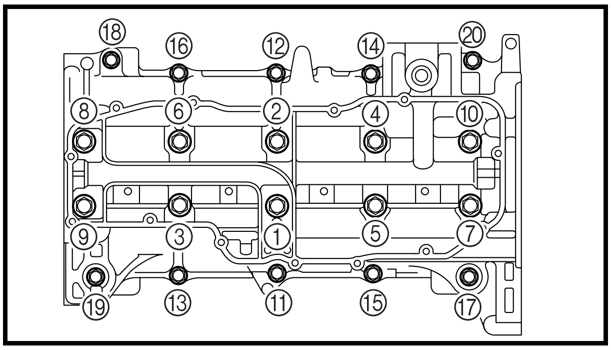

3. Install:
   - Dowel pins ①
   - O-ring ②

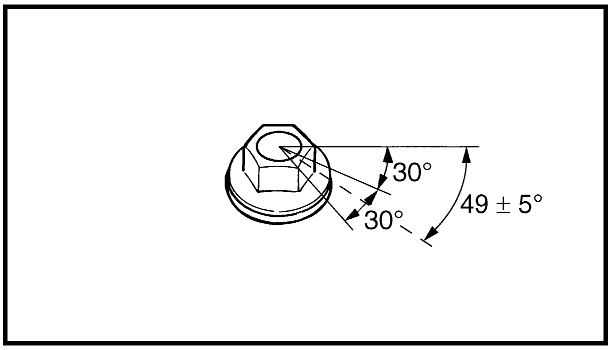



4. Install:
   - Crankcase bolts

**NOTE:**
- Lubricate the bolt ①–⑩ threads and washers with engine oil.
- Finger tighten the crankcase bolts.

M9 × 105 mm bolts: ①–⑩
M6 × 55 mm bolts: ⑪–⑱, ⑳
M6 × 70 mm bolts: ⑲




5. Tighten:
   - Crankcase bolts ①–⑩

**NOTE:**

- Do not reuse crankcase bolts ①–⑩.
- The tightening procedure of crankcase bolts ①–⑩ is angle controlled, therefore tighten the bolts using the following procedure.

**Tightening steps:**

- Tighten the bolts in the order of the numbers on the crankcase.

**Crankcase bolt ①–⑩:**
**1st:**
**7.8 N • m**
**(0.78 kgf • m, 5.6 ft • lb)**

- Loosen and retighten the crankcase bolts in the proper tightening sequence as shown.

**Crankcase bolt ①–⑩:**
**2nd:**
**Loosen completely**
**3rd:**
**15 N • m (1.5 kgf • m, 11 ft • lb)**

- Tighten the crankcase bolts further to reach the specified angle 49° in the proper tightening sequence as shown.

**Crankcase bolt ①–⑩:**
**Final:**
**Specified angle 49 ± 5°**

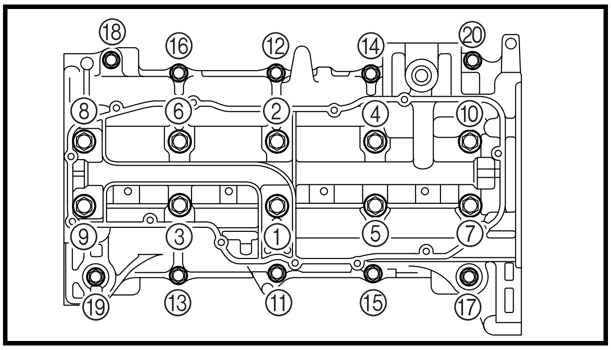
**⚠ WARNING**

**When the bolts are tightened more than the specified angle, do not loosen the bolt and then retighten it.**
**Replace the bolt with a new one and perform the procedure again.**

**CAUTION:**

- **Do not use a torque wrench to tighten the bolt to the specified angle.**
- **Tighten the bolt until it is at the specified angle.**

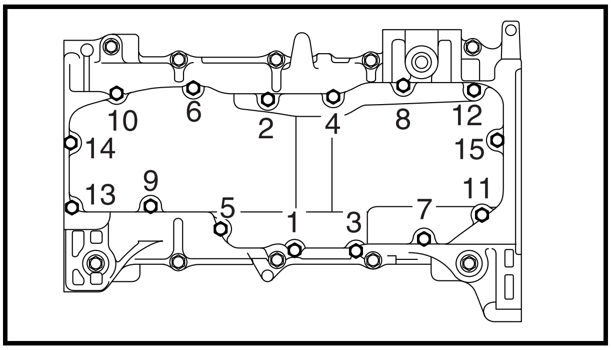
**NOTE:**
When using a hexagonal bolt, note that the angle from one corner to another is 60°.




6. Tighten:
- Crankcase bolts ⑪–⑳

**NOTE:**
Tighten the bolts in the order of the numbers on the crankcase.

**Crankcase bolt ⑪–⑳:**
**12 N • m (1.2 kgf • m, 8.7 ft • lb)**
**LOCTITE 572**

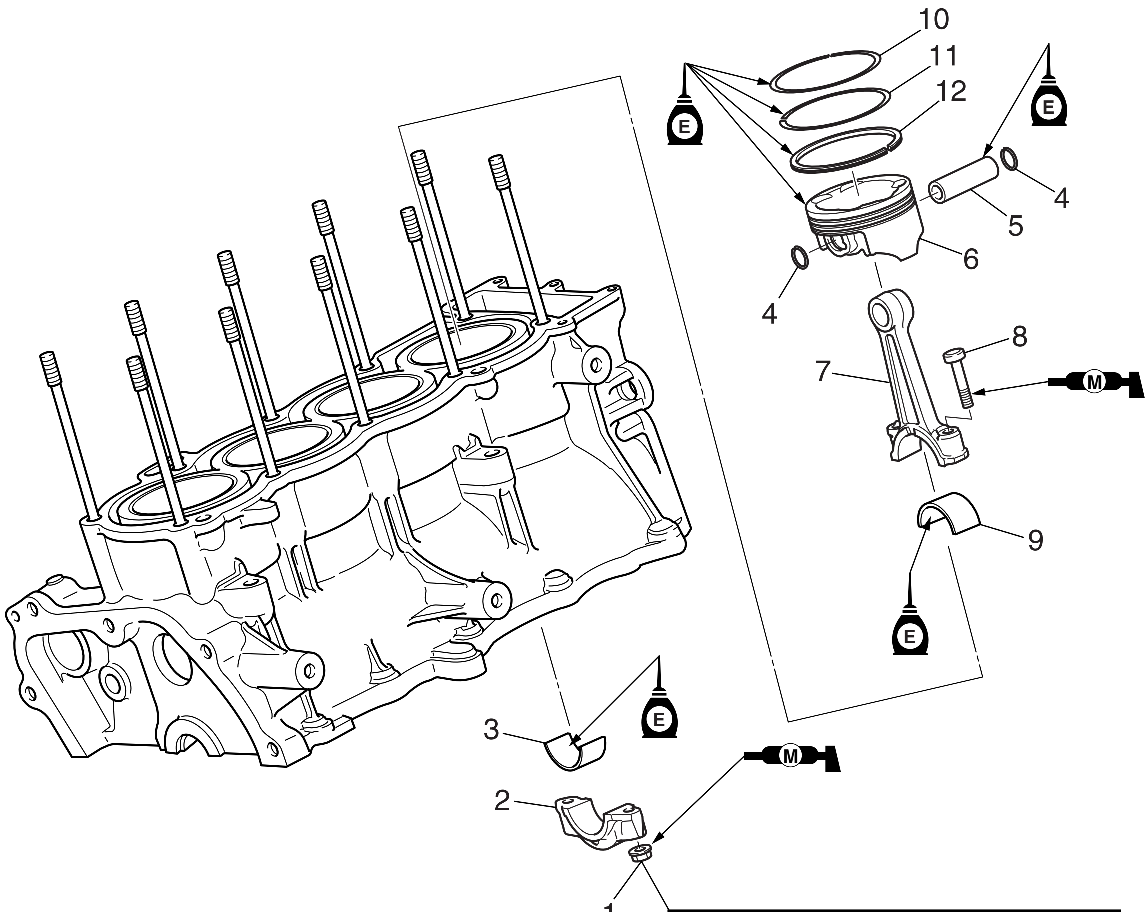



7. Tighten:
- Oil pan bolts

**NOTE:**
Tighten the bolts in the order of the numbers on the oil pan.

**Oil pan bolt:**
**12 N • m (1.2 kgf • m, 8.7 ft • lb)**
**LOCTITE 572**

# CONNECTING RODS AND PISTONS
## EXPLODED DIAGRAM

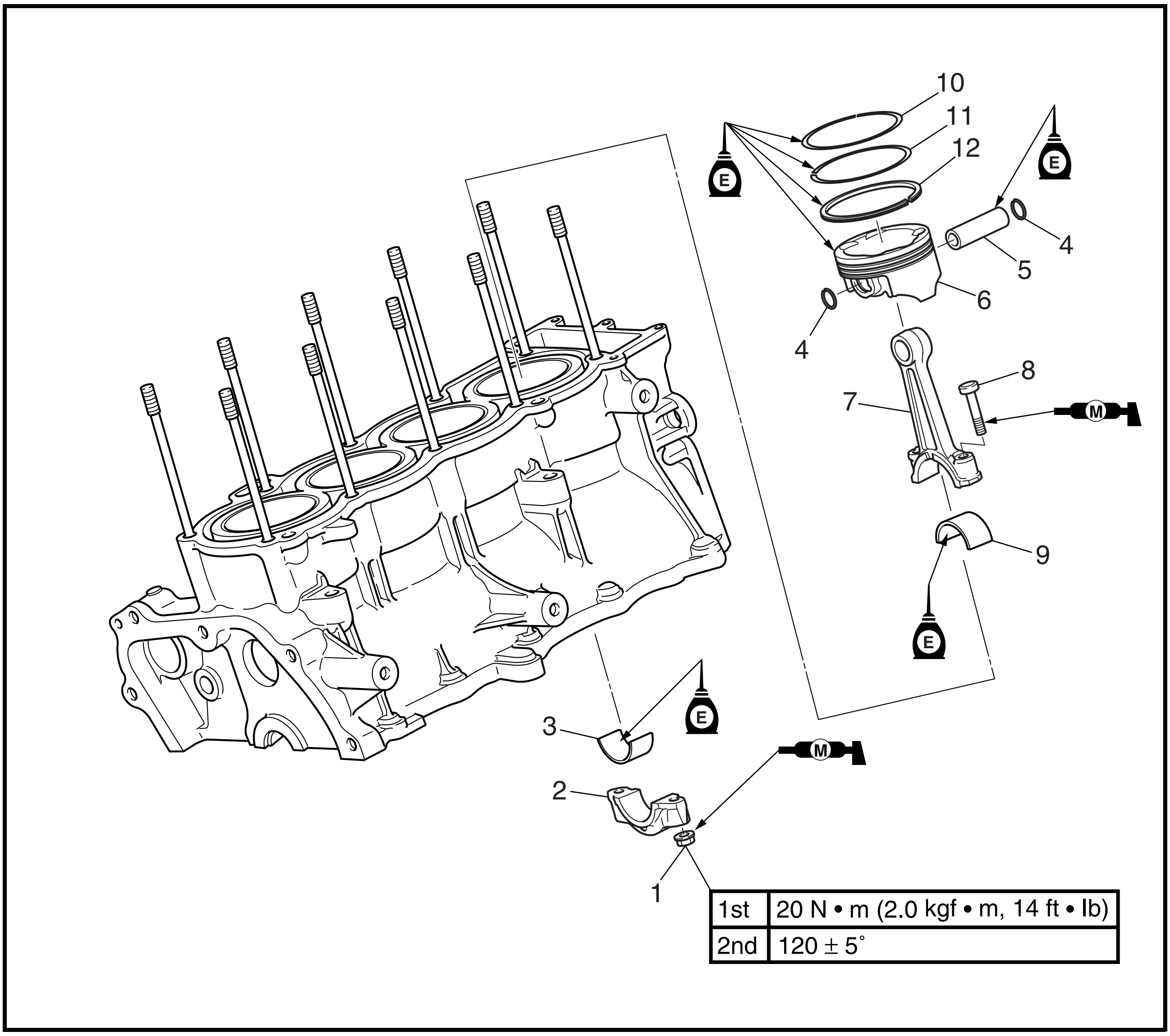



| | |
|---|---|
| 1st | 20 N • m (2.0 kgf • m, 14 ft • lb) |
| 2nd | 120 ± 5° |

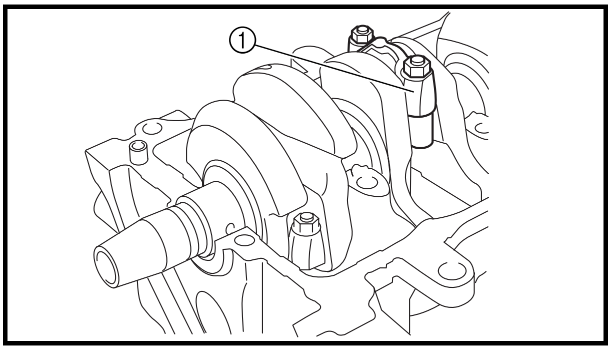
## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **CONNECTING RODS AND PISTONS REMOVAL** | | Follow the left "Step" for removal. |
| | Crankcase | | Separate<br>Refer to "CRANKCASE". |
| 1 | Nut | 8 | **Not reusable** |
| 2 | Connecting rod cap | 4 | |
| 3 | Big end lower bearing | 4 | |
| 4 | Piston pin clip | 8 | **Not reusable** |
| 5 | Piston pin | 4 | |
| 6 | Piston | 4 | |
| 7 | Connecting rod | 4 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Bolt | 8 | **Not reusable** |
| 9 | Big end upper bearing | 4 | |
| 10 | Top ring | 4 | |
| 11 | 2nd ring | 4 | |
| 12 | Oil ring | 4 | |
| | | | Reverse the removal steps for installation. |




## SERVICE POINTS

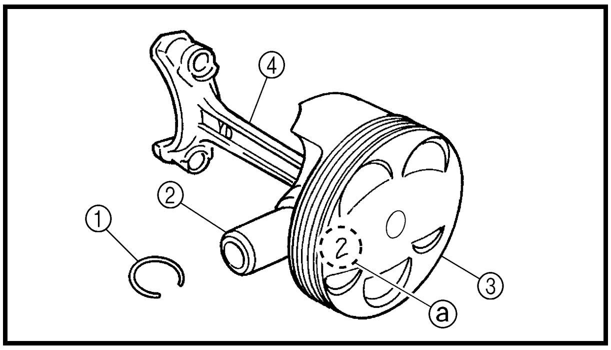
### Connecting rod and piston removal

The following procedure applies to all of the connecting rods and pistons.

1. Remove:
   - Connecting rod cap ①
   - Big end bearings

**NOTE:**

Identify the position of each big end bearing so that it can be reinstalled in its original place.



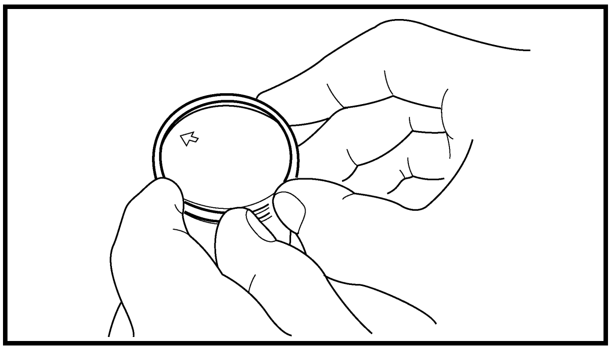

2. Remove:
   - Piston pin clips ①
   - Piston pin ②
   - Piston ③
   - Connecting rod ④

**CAUTION:**

**Do not use a hammer to drive the piston pin out.**

**NOTE:**

- For reference during installation, put an identification number ⓐ on the piston crown.
- Before removing the piston pin, deburr the piston pin clip's groove and the piston's pin bore area.



3. Remove:
   - Top ring
   - 2nd ring
   - Oil ring

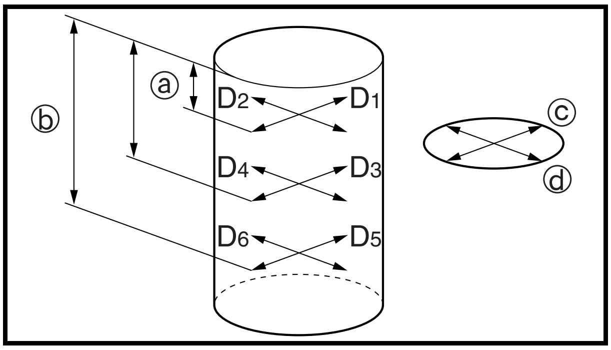
**NOTE:**

When removing a piston ring, open the end gap with your fingers and lift the other side of the ring over the piston crown.

### Cylinder and piston inspection

The following procedure applies to all of the cylinders and pistons.

1. Check:
   - Piston wall
   - Cylinder wall
     Vertical scratches → Replace the cylinder, and the piston and piston rings as a set.



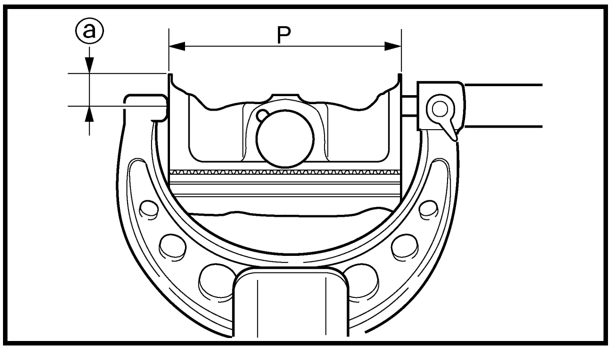

2. Measure:
   - Piston-to-cylinder clearance

**Measurement steps:**
- Measure cylinder bore “C” with the cylinder bore gauge.

| | |
|---|---|
| **Cylinder bore “C”** | **76.000–76.015 mm (2.9921–2.9927 in)** |
| **Taper limit “T”** | **0.08 mm (0.003 in)** |
| **Out of round “R”** | **0.05 mm (0.002 in)** |
| **“C” = maximum of $D_1$–$D_6$** | |
| **“T” = maximum of $D_1$–$D_5$ (direction ⓒ) and $D_2$–$D_6$ (direction ⓓ)** | |
| **“R” = maximum of $D_2$–$D_1$ (measuring point ⓐ) and $D_6$–$D_5$ (measuring point ⓑ)** | |

- If out of specification, replace the cylinder, and the piston and piston rings as a set.
- Measure piston skirt diameter “P” with the micrometer.

ⓐ 5 mm (0.2 in) from the bottom edge of the piston



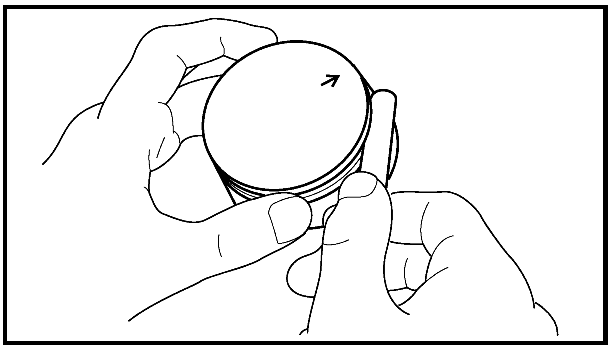

| | Piston size “P” |
|---|---|
| **Standard** | **75.895–75.910 mm (2.9880–2.9986 in)** |

- If out of specification, replace the piston and piston rings as a set.
- Calculate the piston-to-cylinder clearance with the following formula.

**Piston-to-cylinder clearance = Cylinder bore “C” – Piston skirt diameter “P”**

**Piston-to-cylinder clearance:**
**0.10–0.11 mm (0.0039–0.0043 in)**
**<Limit>: 0.17 mm (0.0067 in)**

- If out of specification, replace the piston and piston rings as a set.

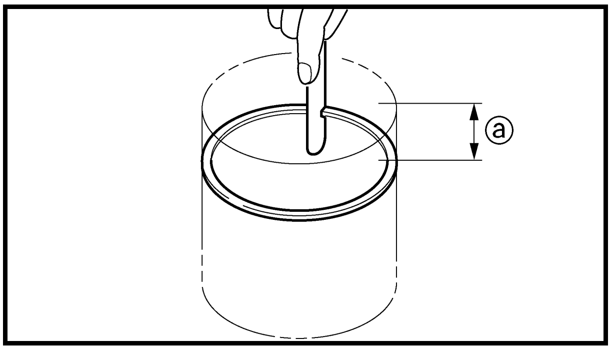


**Piston ring inspection**

1. Measure:
   - Piston ring side clearance
     Out of specification → Replace the piston and piston rings as a set.

**NOTE:**
Before measuring the piston ring side clearance, eliminate any carbon deposits from the piston ring grooves and piston rings.

**Side clearance:**
**Top ring:**
**0.030–0.065 mm**
**(0.0012–0.0026 in)**
**2nd ring:**
**0.020–0.055 mm**
**(0.0008–0.0022 in)**
**Oil ring:**
**0.040–0.160 mm**
**(0.0016–0.0063 in)**



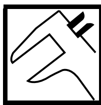

2. Install:
   - Piston ring
     (into the cylinder)

**NOTE:**
Level the piston ring in the cylinder with the piston crown.

ⓐ 5 mm (0.2 in)

3. Measure:
   - Piston ring end gap
     Out of specification → Replace the piston ring.

**NOTE:**
The oil ring expander spacer's end gap cannot be measured. If the oil ring rail's gap is excessive, replace all three piston rings.

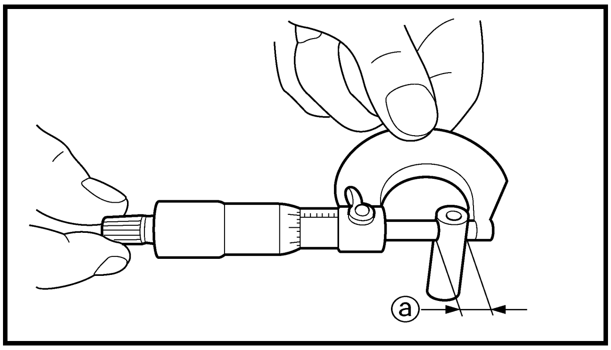


**Piston ring end gap:**
**Top ring:**
**0.32–0.44 mm**
**(0.0126–0.0173 in)**
**2nd ring:**
**0.43–0.58 mm**
**(0.0169–0.0228 in)**
**Oil ring:**
**0.10–0.35 mm**
**(0.0039–0.0138 in)**

**Piston pin inspection**

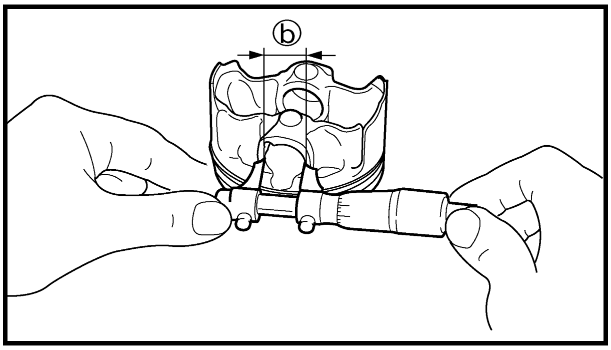
The following procedure applies to all of the piston pins.

1. Check:
   - Piston pin
     Bluediscoloration/grooves → Replace the piston pin and then check the lubrication system.




2. Measure:
   - Piston pin outside diameter ⓐ
     Out of specification → Replace the piston pin.

**Piston pin outside diameter:**
**16.991–17.000 mm**
**(0.6689–0.6693 in)**
**<Limit>: 16.98 mm (0.67 in)**



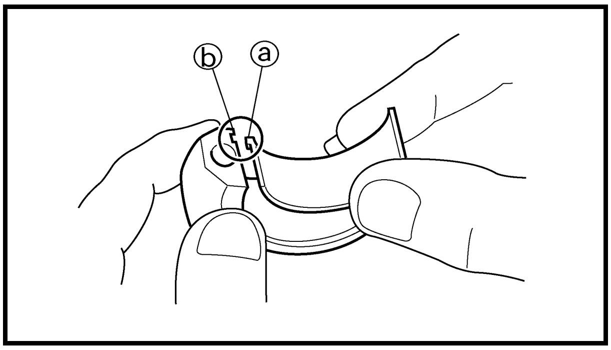

3. Measure:
   - Piston pin bore diameter (in the piston) ⓑ
     Out of specification → Replace the piston.

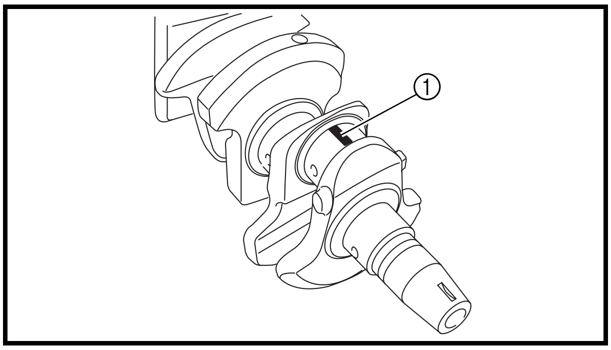
**Piston pin bore diameter (in the piston):**
**17.002–17.013 mm**
**(0.6694–0.6698 in)**

4. Calculate:
   - Piston-pin-to-piston clearance
     Out of specification → Replace the piston pin.

**Piston-pin-to-piston clearance =**
**Piston pin bore diameter (in the piston) ⓑ – Piston pin outside diameter ⓐ**

**Piston-pin-to-piston clearance:**
**0.002–0.022 mm**
**(0.0001–0.0009 in)**




**Connecting rod inspection**

1. Measure:
   - Big end oil clearance
     Out of specification → Replace the big end bearings.

> **Big end oil clearance:**
> **0.016–0.040 mm**
> **(0.0006–0.0016 in)**

**Measurement steps:**

The following procedure applies to all of the connecting rods.

**CAUTION:**

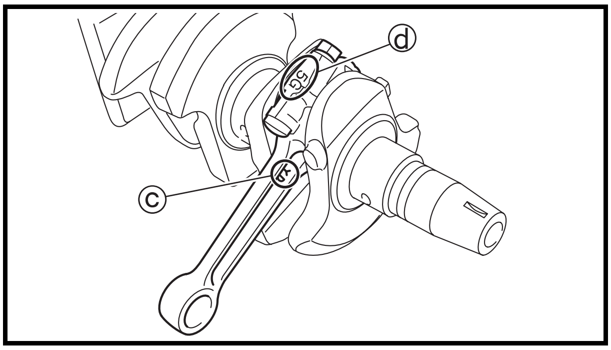
**Do not interchange the big end bearings and connecting rods. To obtain the correct big end oil clearance and prevent engine damage, the big end bearings must be installed in their original positions.**

- Clean the big end bearings, crankshaft pins, and the inside of the connecting rod halves.
- Install the big end upper bearing into the connecting rod and the big end lower bearing into the connecting rod cap.

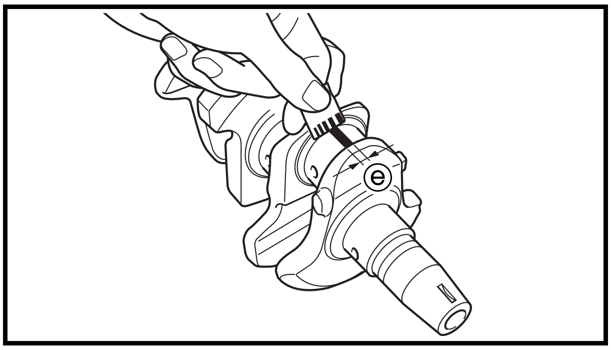
**NOTE:**

Align the projections ⓐ on the big end bearings with the notches ⓑ in the connecting rod and connecting rod cap.

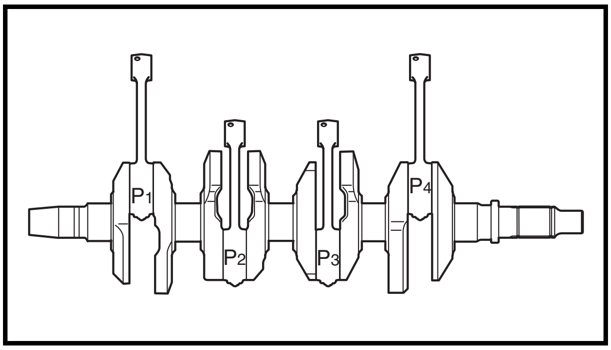
- Put a piece of Plastigauge ① on the crankshaft pin.
- Assemble the connecting rod halves.




**NOTE:**
- Do not move the connecting rod or crankshaft until the clearance measurement has been completed.
- Lubricate the bolts threads and nut seats with molybdenum disulfide grease.
- Make sure the "Y" mark ⓒ on the connecting rod faces towards the front side of the crankshaft.
- Make sure the characters ⓓ on both the connecting rod and connecting rod cap are aligned.

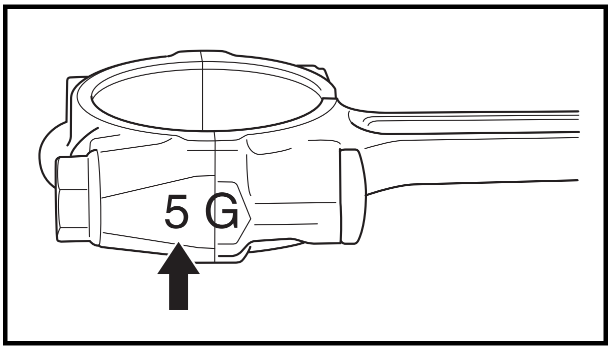


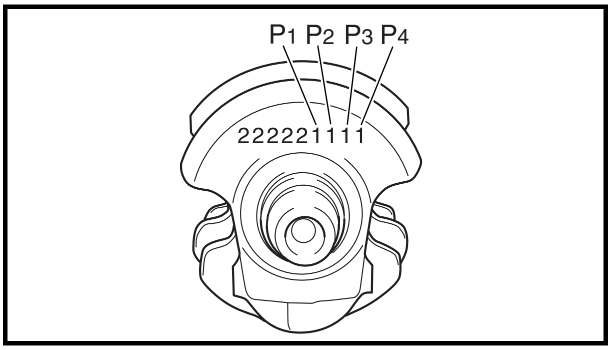

- Tighten the connecting rod nuts.
  Refer to "Connecting rod and piston installation".
- Remove the connecting rod and big end bearings.
  Refer to "Connecting rod and piston removal".
- Measure the compressed Plastigauge width ⓔ on the crankshaft pin.
  If the big end oil clearance is out of specification, select replacement big end bearings.




2. Select:
   - Big end bearings ($P_1$–$P_4$)

**NOTE:**
- The numbers stamped into the crankshaft web and the numbers on the connecting rods are used to determine the replacement big end bearing sizes.
- "$P_1$"–"$P_4$" refer to the bearings shown in the crankshaft illustration.

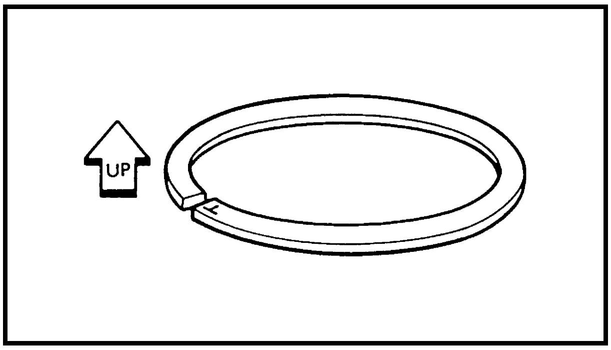



For example, if the connecting rod “P1” and the crankshaft web “P1” numbers are “5” and “1” respectively, then the bearing size for “P1” is:

**Bearing size of P1:**
**“P1” (connecting rod) –**
**“P1” (crankshaft web)**
**5 – 1 = 4 (green)**

| BEARING COLOR CODE | |
|---|---|
| **1** | **brown** |
| **2** | **black** |
| **3** | **blue** |
| **4** | **green** |



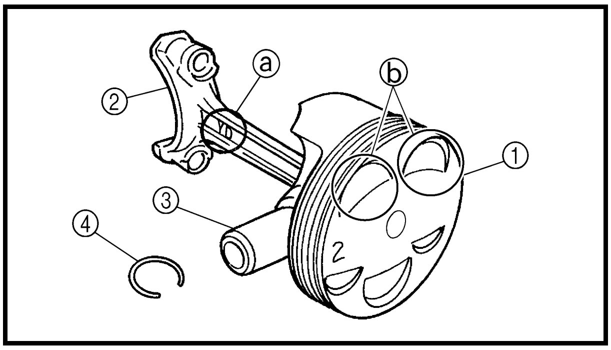

**Connecting rod and piston installation**

The following procedure applies to all of the pistons and connecting rods.

1. Install:
   - Oil ring
   - 2nd ring
   - Top ring

**NOTE:**

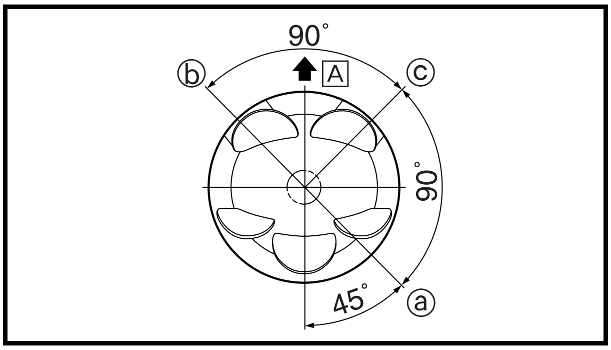
Be sure to install the piston rings so that the manufacturer’s marks or numbers face up.




2. Install:
   - Piston ①
   - Connecting rod ②
   - Piston pin ③
   - Piston pin clips ④

**NOTE:**

- Apply engine oil onto the piston pin.
- When installing the connecting rod to the piston, make sure that the “Y” mark ⓐ on the connecting rod faces towards the left when the exhaust valve recesses ⓑ on the piston face upward. Refer to the illustration.
- Reinstall each piston into its original cylinder (numbering order starting from the front: #1 to #4).




3. Offset:
   - Piston ring end gaps

ⓐ Top ring, oil ring expander spacer
ⓑ 2nd ring, lower oil ring rail
ⓒ Upper oil ring rail
A Exhaust side

4. Lubricate:
   - Piston
   - Piston rings
   - Cylinder
   (with the recommended lubricant)

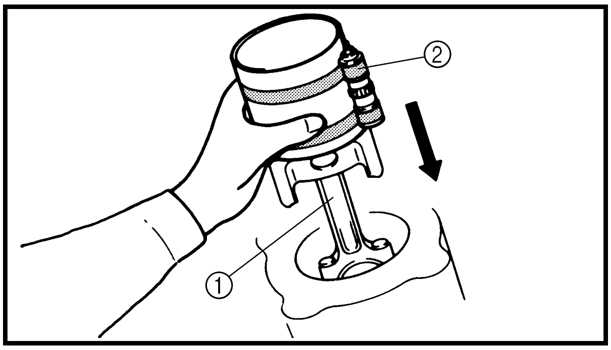
**Recommended lubricant:**
**Engine oil**

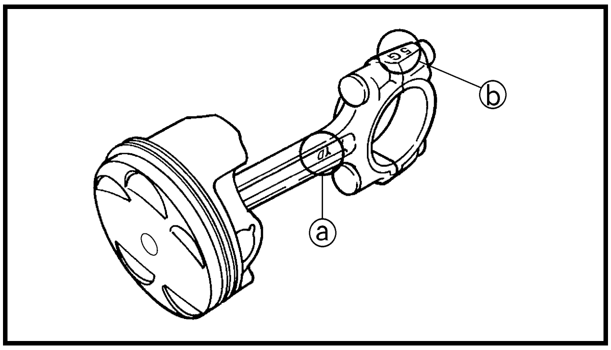
5. Lubricate:
   - Bolt threads
   - Nut seats
   (with the recommended lubricant)

**Recommended lubricant:**
**Molybdenum disulfide grease**

6. Lubricate:
   - Crankshaft pins
   - Big end bearings
   (with the recommended lubricant)

**Recommended lubricant:**
**Engine oil**



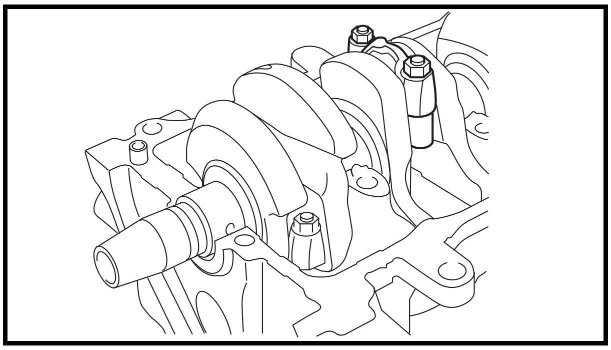

7. Install:
   - Big end bearings
   - Connecting rod assembly ①
     (into the cylinder and onto the crankshaft pin)
   - Connecting rod cap
     (onto the crankshaft pin)

**NOTE:**

- Align the projections on the big end bearings with the notches in the connecting rods and connecting rod caps.
- Be sure to reinstall each big end bearing in its original place.
- While compressing the piston rings with piston ring compressor ②, install the connecting rod assembly into the cylinder with the other hand.
- Make sure the "Y" marks ⓐ on the connecting rods face towards the front side of the crankshaft.
- Make sure the characters ⓑ on both the connecting rod and connecting rod cap are aligned.

**Piston ring compressor:**
**YM-08037/90890-05158**

8. Align:
   - Bolt heads
     (with the connecting rod)



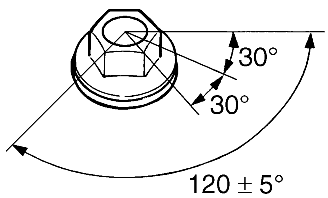
9. Tighten:
   - Connecting rod nuts

**WARNING**

- **Replace the connecting rod bolts and nuts with new ones.**
- **Clean the connecting rod bolts and nuts.**

**NOTE:**

The tightening procedure of the connecting rod nuts is angle controlled, therefore tighten the nuts using the following procedure.




**Tightening steps:**

- Tighten the connecting rod nuts to the specified torque.

**Connecting rod nut:**
**1st:**
**20 N • m (2.0 kgf • m, 14 ft • lb)**

- Tighten the connecting rod nuts further to reach the specified angle 120°.

**Connecting rod nut:**
**Final:**
**Specified angle 120 ± 5°**

**WARNING**

**When the nuts are tightened more than the specified angle, do not loosen the nut and then retighten it.**
**Replace the bolt and nut with a new one and perform the procedure again.**

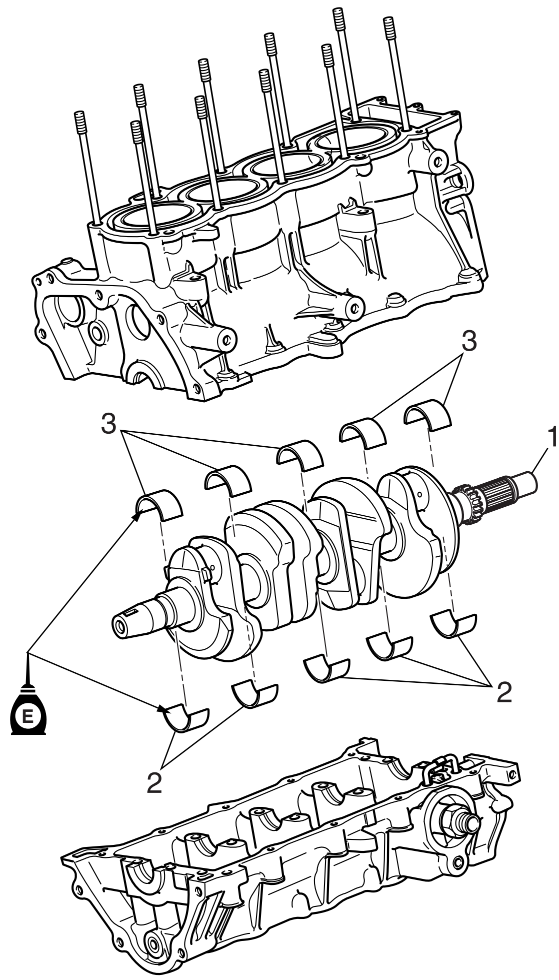
**CAUTION:**

- **Do not use a torque wrench to tighten the nut to the specified angle.**
- **Tighten the nut until it is at the specified angle.**

**NOTE:**

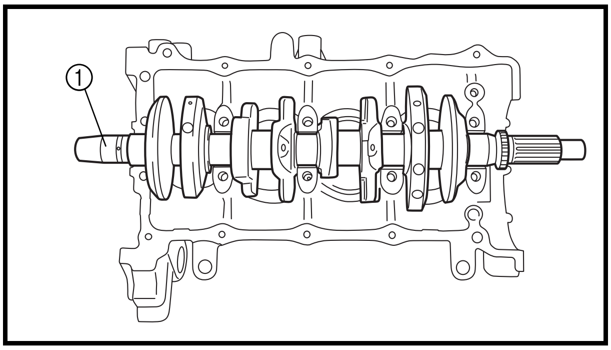
When using a hexagonal nut, note that the angle from one corner to another is 60°.

# CRANKSHAFT
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **CRANKSHAFT REMOVAL** | | Follow the left "Step" for removal. |
| | Crankcase | | Separate<br>Refer to "CRANKCASE". |
| | Connecting rod caps | | Refer to "CONNECTING RODS AND PISTONS". |
| 1 | Crankshaft | 1 | |
| 2 | Crankshaft journal lower bearing | 5 | |
| 3 | Crankshaft journal upper bearing | 5 | |
| | | | Reverse the removal steps for installation. |

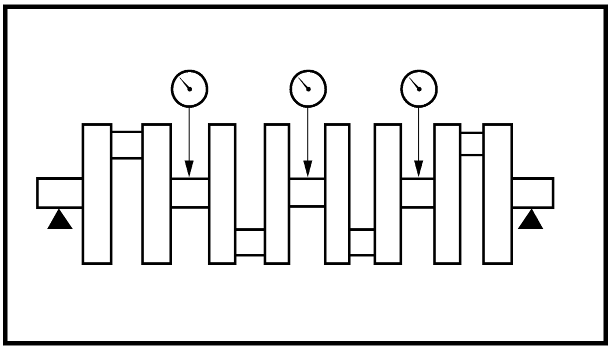



## SERVICE POINTS

### Crankshaft removal

1. Remove:
   - Crankshaft ①
   - Crankshaft journal lower bearings (from the lower crankcase)
   - Crankshaft journal upper bearings (from the upper crankcase)

**NOTE:**
Identify the position of each crankshaft journal bearing so that it can be reinstalled in its original place.



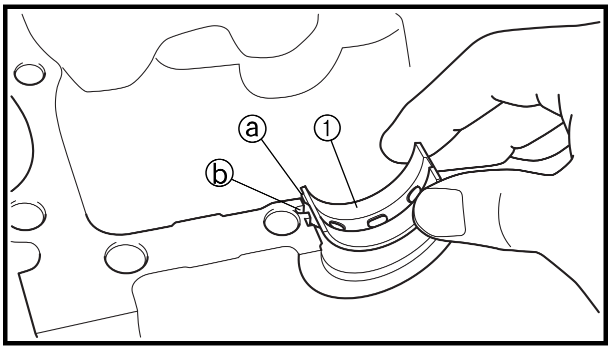
### Crankshaft inspection

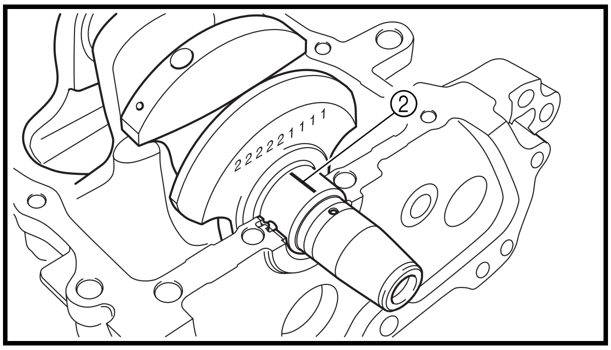
1. Measure:
   - Crankshaft runout
     Out of specification → Replace the crankshaft.

**Maximum crankshaft runout:**
**0.03 mm (0.0012 in)**

2. Check:
   - Crankshaft journal surfaces
   - Crankshaft pin surfaces
     Scratches/wear → Replace the crankshaft.
   - Bearing surfaces
     Scratches/wear → Replace the crankshaft journal bearing.
3. Measure:
   - Crankshaft journal oil clearance
     Out of specification → Replace the crankshaft journal bearings.

**Crankshaft journal oil clearance:**
**0.004–0.028 mm**
**(0.0002–0.0011 in)**




**CAUTION:**

**Do not interchange the crankshaft journal bearings. To obtain the correct crankshaft journal oil clearance and prevent engine damage, the crankshaft journal bearings must be installed in their original positions.**

**Measurement steps:**

- Clean the crankshaft journal bearings, crankshaft journals, and bearing portions of the crankcase.
- Place the upper crankcase upside down on a bench.
- Install the crankshaft journal upper bearings ① and the crankshaft into the upper crankcase.

**NOTE:**

Align the projections ⓐ of the crankshaft journal upper bearings with the notches ⓑ in the upper crankcase.

- Put a piece of Plastigauge ② on each crankshaft journal.

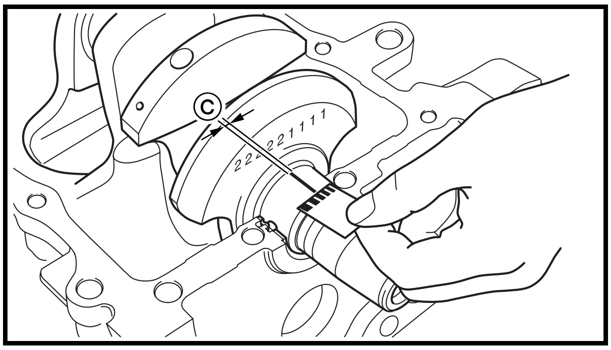
**NOTE:**

Do not put the Plastigauge over the oil hole in the crankshaft journal.

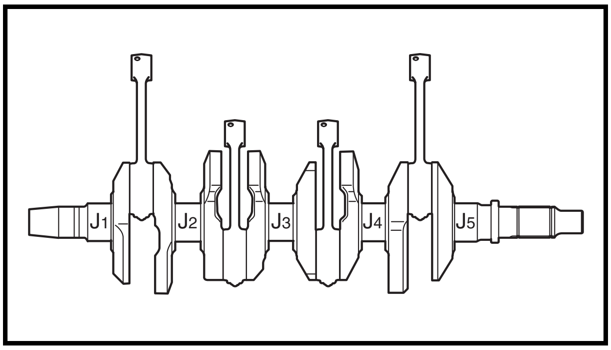
- Install the crankshaft journal lower bearings into the lower crankcase and assemble the crankcase halves.

**NOTE:**

- Align the projections ⓐ of the crankshaft journal lower bearings with the notches ⓑ in the lower crankcase.
- Do not move the crankshaft until the clearance measurement has been completed.

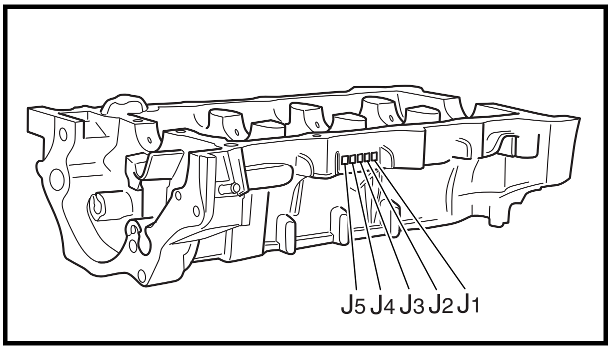



- Tighten the bolts to specification in the order of the numbers on the crankcase. Refer to "Crankcase assembly"—"CRANKCASE".
- Remove the lower crankcase and the crankshaft journal lower bearings.
- Measure the compressed Plastigauge width ⓒ on each crankshaft journal. If the crankshaft journal oil clearance is out of specification, select replacement crankshaft journal bearings.



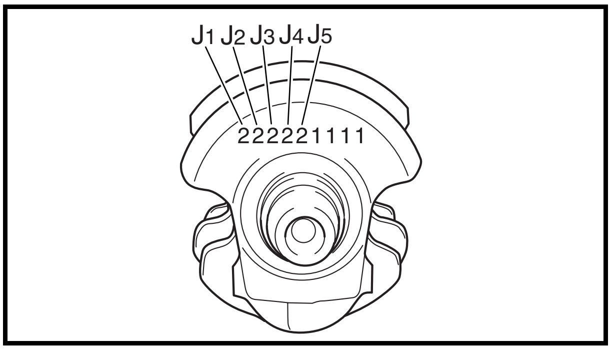

4. Select:
   - Crankshaft journal bearings ($J_1$–$J_5$)

**NOTE:**
- The numbers stamped into the crankshaft web and the numbers stamped into the lower crankcase are used to determine the replacement crankshaft journal bearing sizes.
- "$J_1$–$J_5$" refer to the bearings shown in the crankshaft illustration.
- If "$J_1$–$J_5$" are the same, use the same size for all of the bearings.

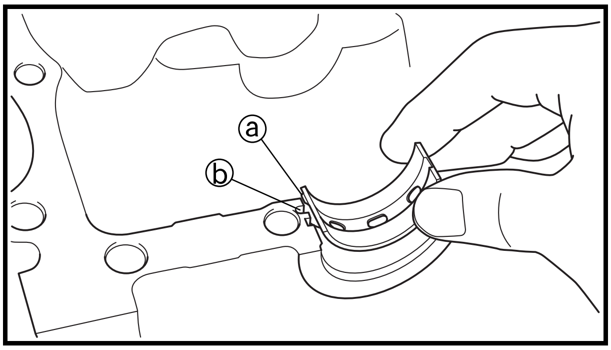



For example, if the crankcase "$J_1$" and crankshaft web "$J_1$" numbers are "8" and "2" respectively, then the bearing size for "$J_1$" is:

**Bearing size of $J_1$:**
**"$J_1$" (crankcase) – "$J_1$" (crankshaft web) – 1**
**8 – 2 – 1 = 5 (Red/black)**




| BEARING COLOR CODE | |
|---|---|
| **3** | **Red/red** |
| **4** | **Red/brown** |
| **5** | **Red/black** |
| **6** | **Red/blue** |
| **7** | **Red/green** |




**Crankshaft installation**

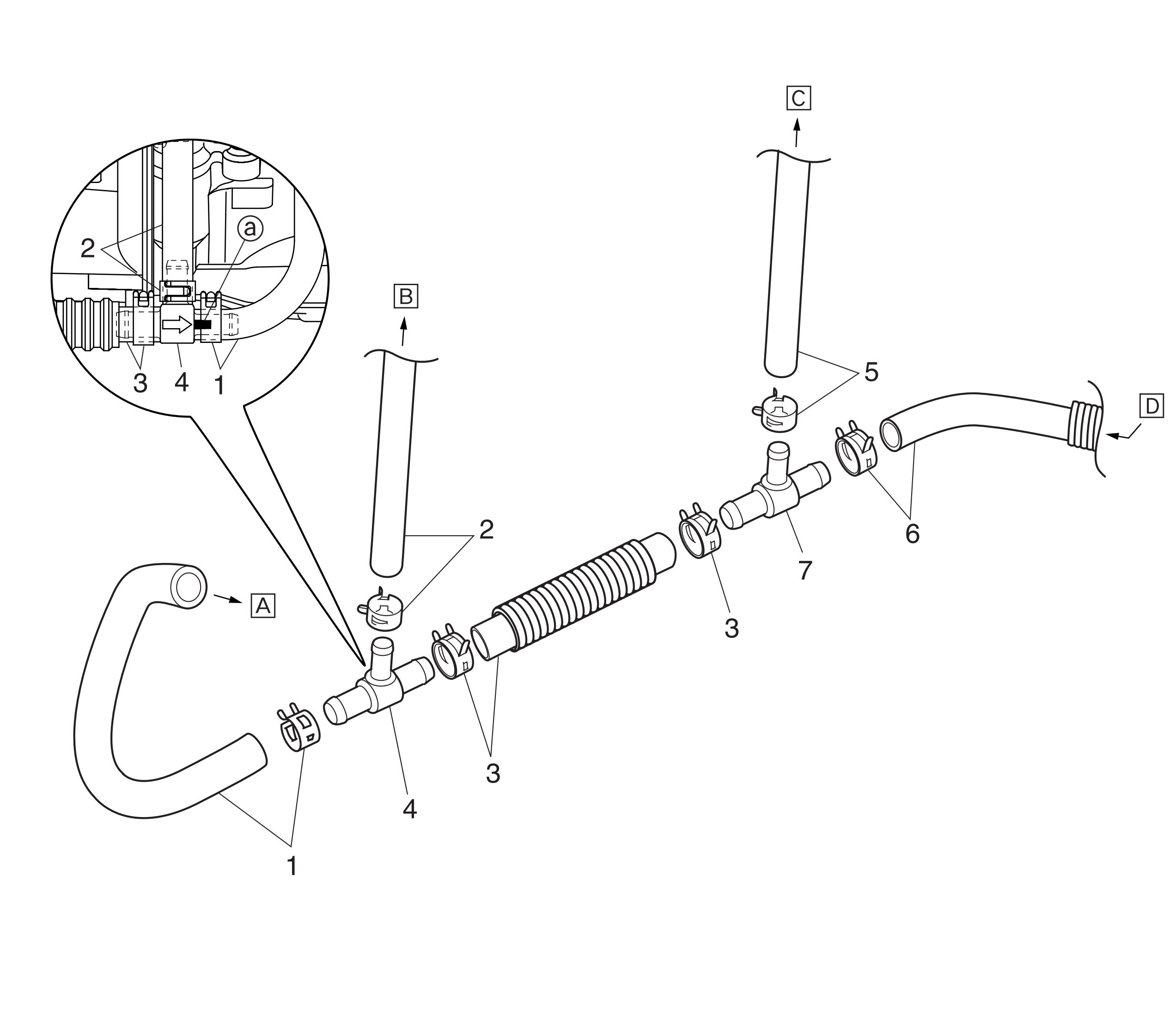
1. Install:
   - Crankshaft journal upper bearings (into the upper crankcase)
   - Crankshaft journal lower bearings (into the lower crankcase)

**NOTE:**
- Align the projections ⓐ on the crankshaft journal upper bearings with the notches ⓑ in the upper crankcase.
- Be sure to install each crankshaft journal bearing in its original place.

2. Lubricate:
   - Crankshaft journals
   - Crankshaft journal bearings (with the recommended lubricant)

| | **Recommended lubricant:**<br>**Engine oil** |
|---|---|

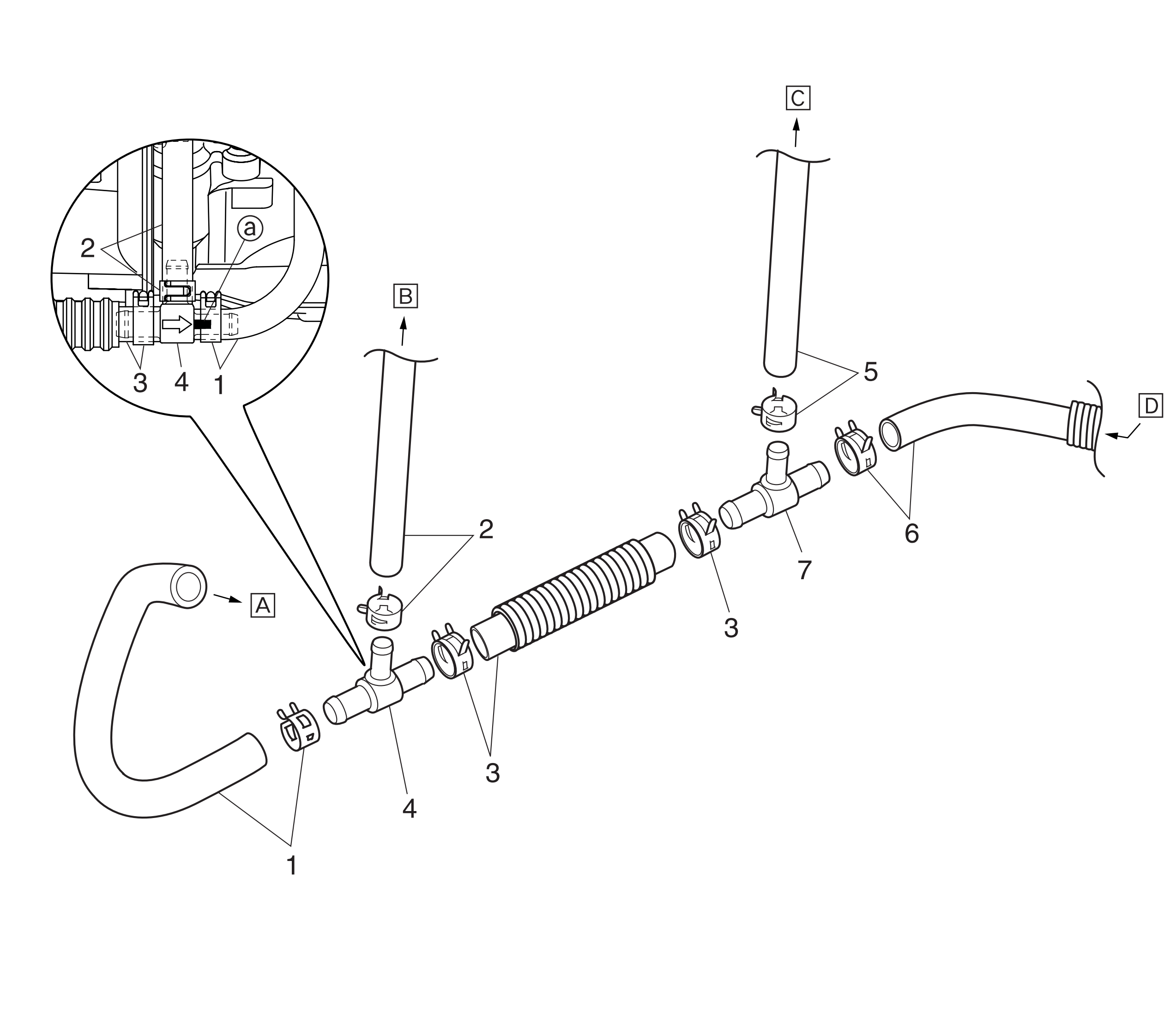
# COOLING WATER HOSE
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **COOLING WATER HOSE REMOVAL** | | Follow the left "Step" for removal. |
| | Exhaust manifold | | Refer to "EXHAUST MANIFOLD". |
| 1 | Clamp/cooling water hose | 1/1 | A To cylinder block<br>**NOTE:**<br>To install the cooling water hose, align the white paint mark ⓐ water hose with the projection of the hose joint. |
| 2 | Clamp/cooling water hose | 1/1 | B To exhaust manifold |
| 3 | Clamp/cooling water hose | 2/1 | |

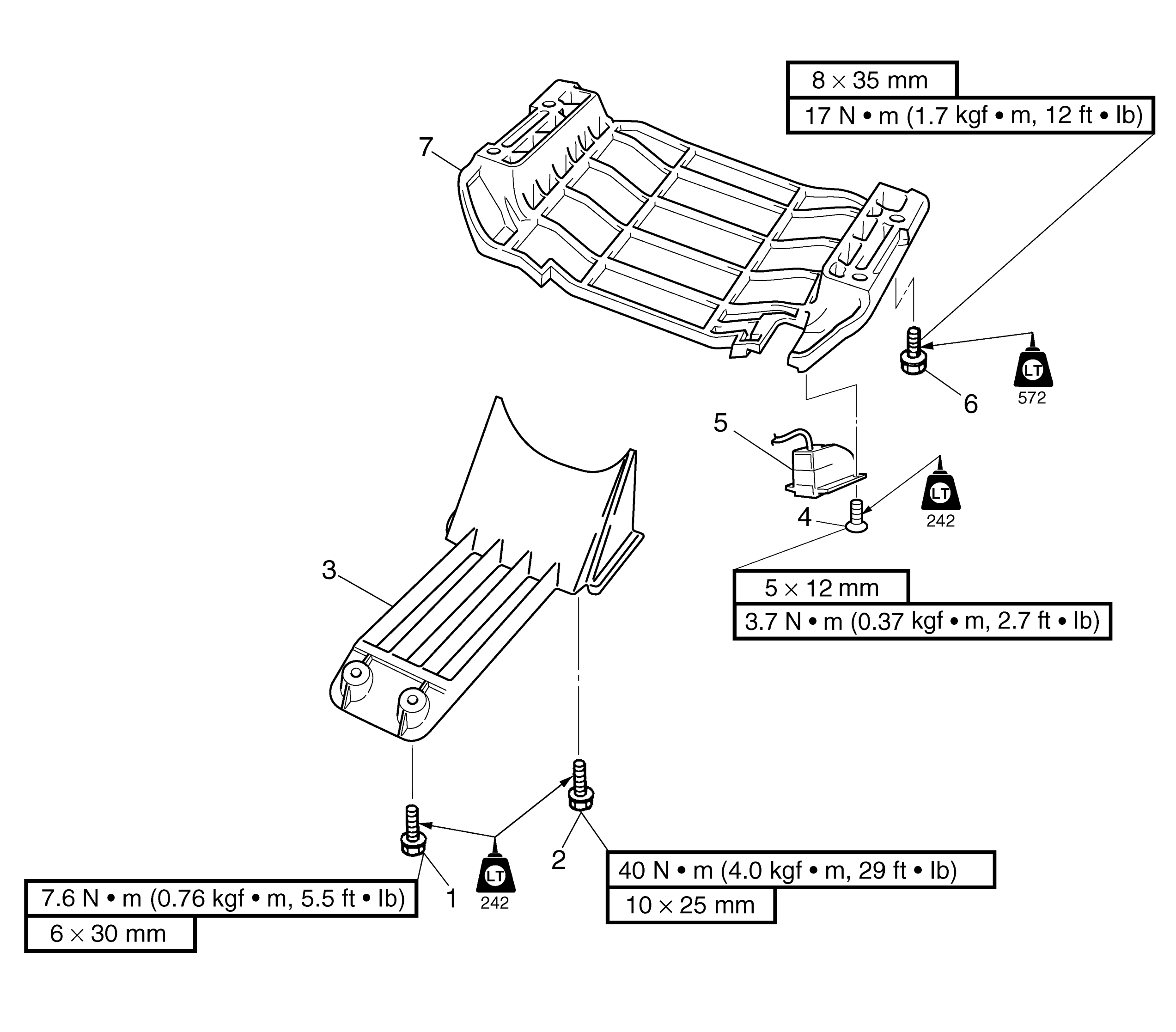
## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 4 | Joint | 1 | |
| 5 | Clamp/cooling water hose | 1/1 | C To oil tank |
| 6 | Clamp/cooling water hose | 1/1 | D From transom plate |
| 7 | Joint | 1 | |
| | | | Reverse the removal steps for installation. |

# CHAPTER 6
# JET PUMP UNIT

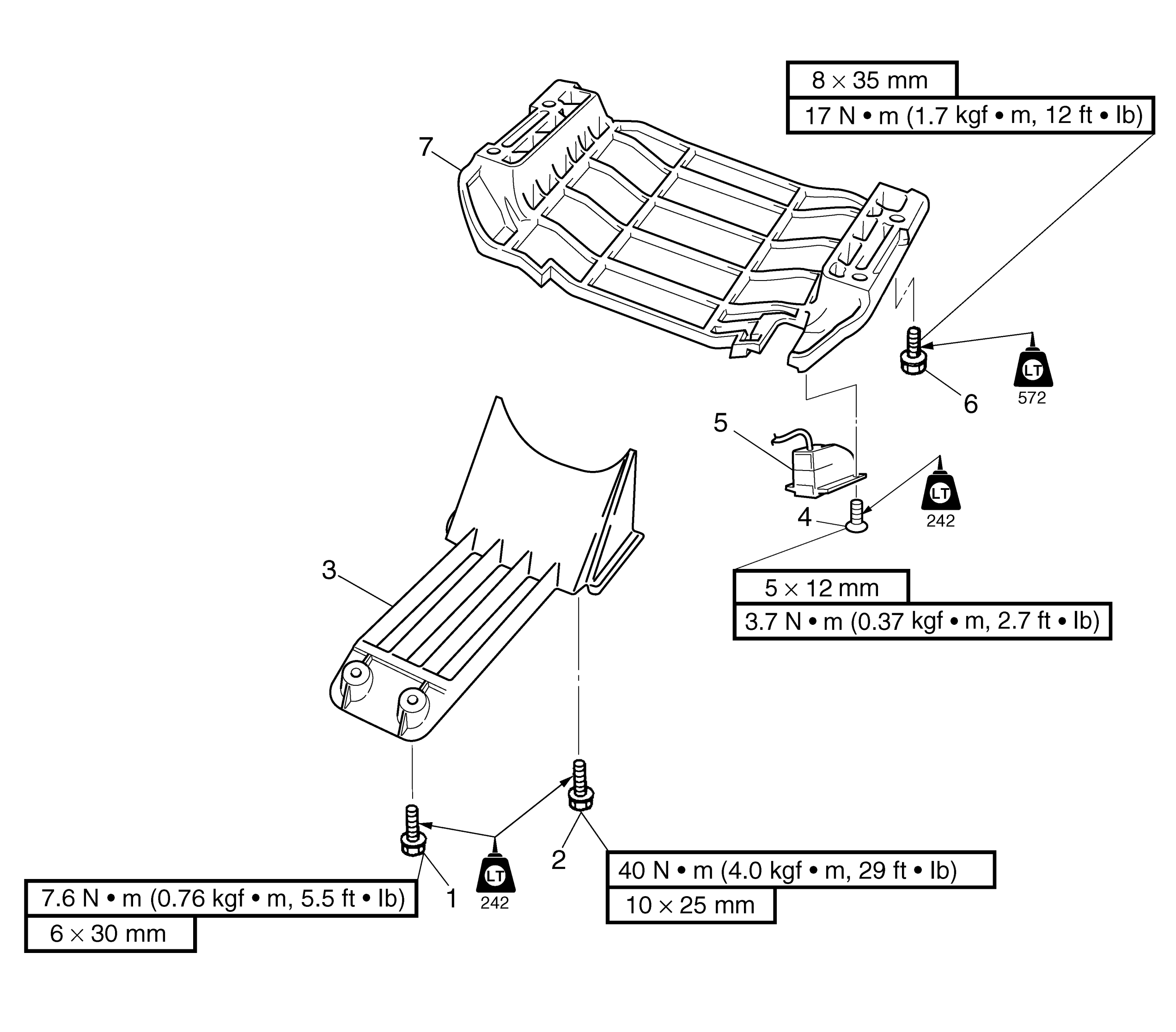
# INTAKE GRATE AND RIDE PLATE
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

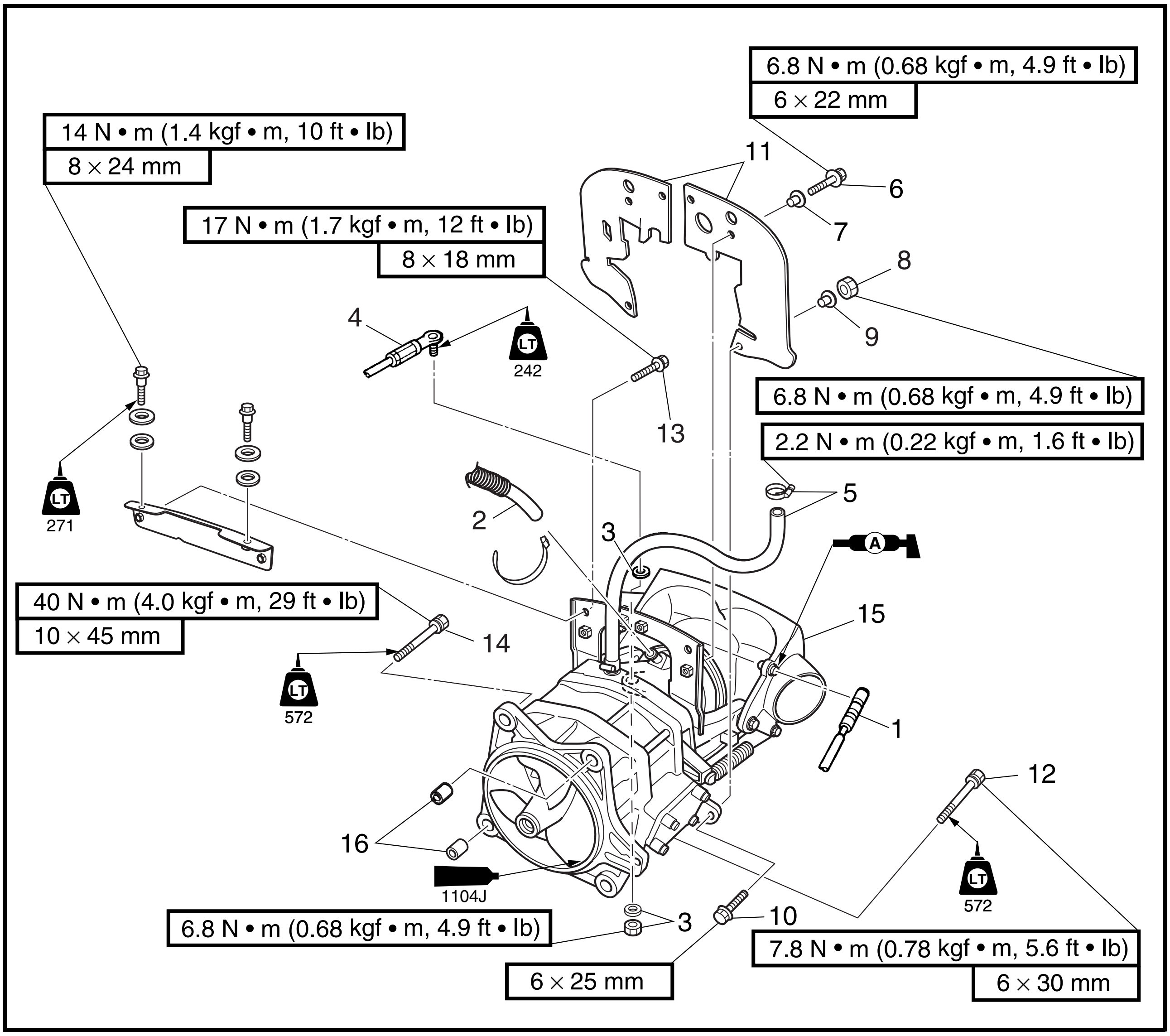
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **INTAKE GRATE, RIDE PLATE, AND INTAKE DUCT REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Bolt | 2 | |
| 2 | Bolt | 2 | |
| 3 | Intake grate | 1 | |
| 4 | Screw | 4 | |
| 5 | Speed sensor | 1 | **NOTE:** Route the speed sensor lead between the jet pump unit and the bilge hose. |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 6 | Bolt | 4 | |
| 7 | Ride plate | 1 | |
| | | | Reverse the removal steps for installation. |

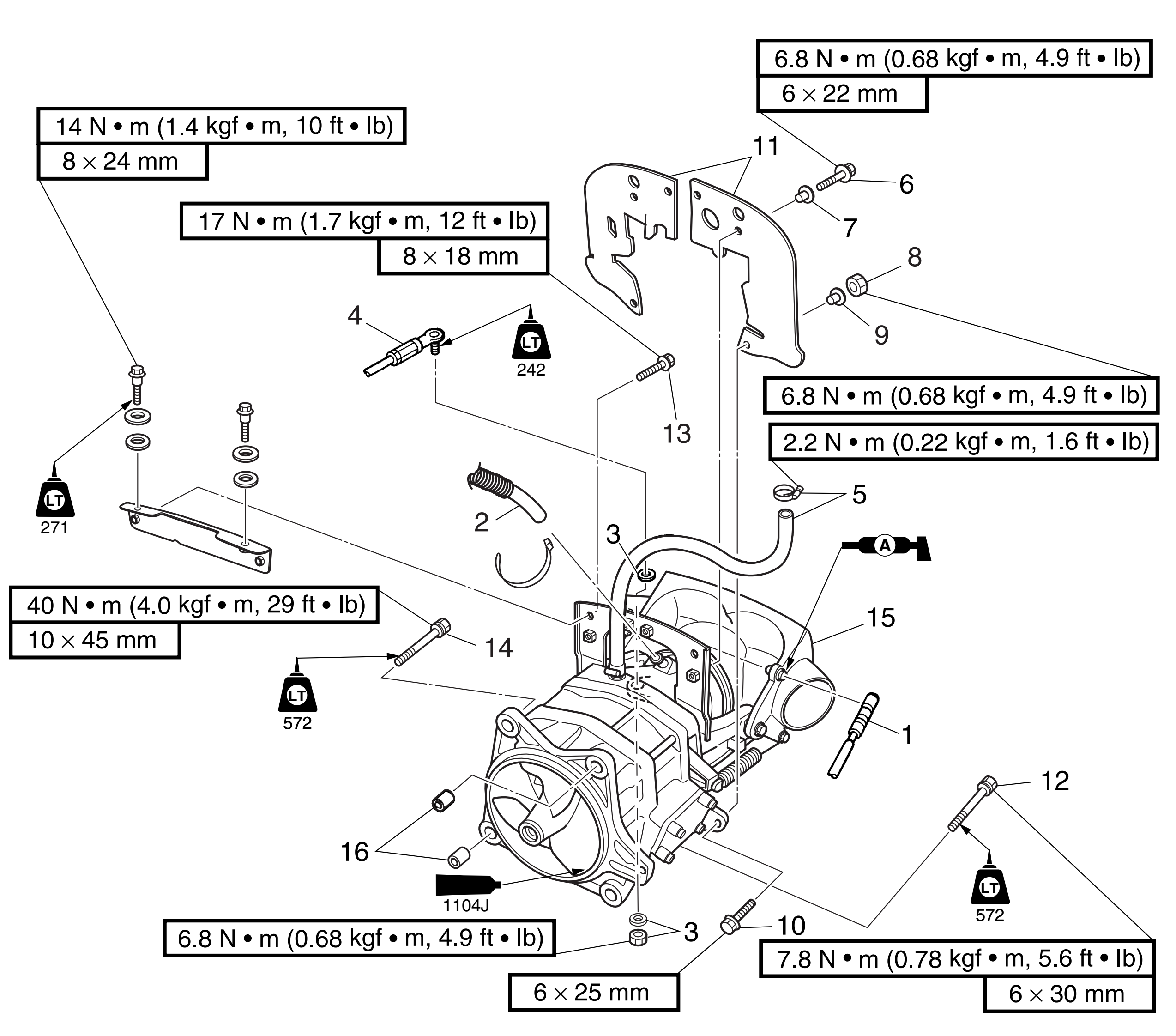
# JET PUMP UNIT
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

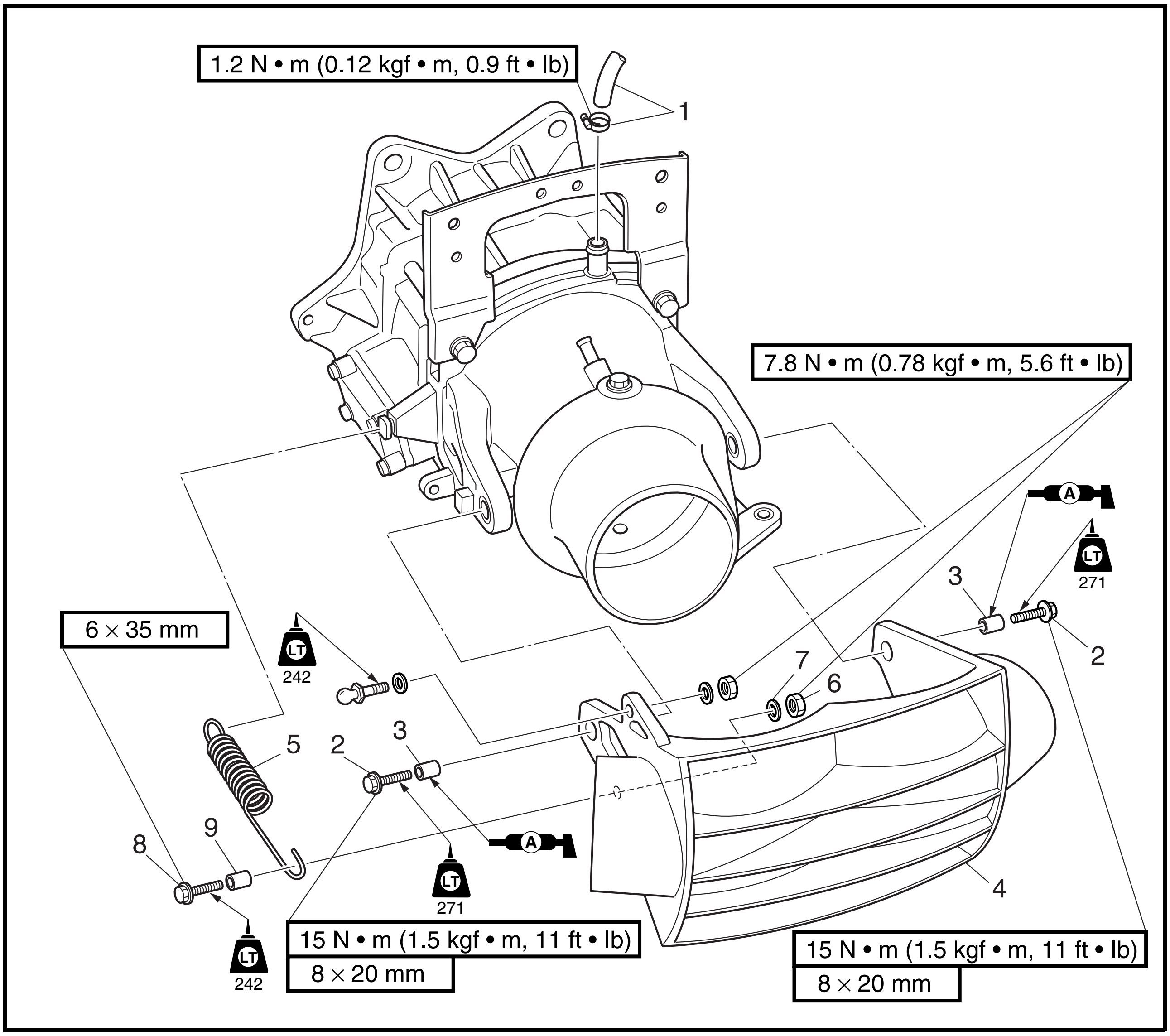
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **JET PUMP UNIT REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Shift cable joint | 1 | Deluxe model only |
| 2 | Bilge hose | 1 | |
| 3 | Nut/washer | 1/2 | |
| 4 | Steering cable joint | 1 | |
| 5 | Hose clamp/spout hose | 1/1 | |
| 6 | Bolt | 4 | |
| 7 | Collar | 4 | |
| 8 | Nut | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 9 | Collar | 2 | |
| 10 | Bolt | 2 | |
| 11 | Rubber plate | 2 | |
| 12 | Bolt | 1 | |
| 13 | Bolt | 2 | |
| 14 | Bolt | 4 | |
| 15 | Jet pump unit assembly | 1 | |
| 16 | Dowel pin | 2 | |
| | | | Reverse the removal steps for installation. |

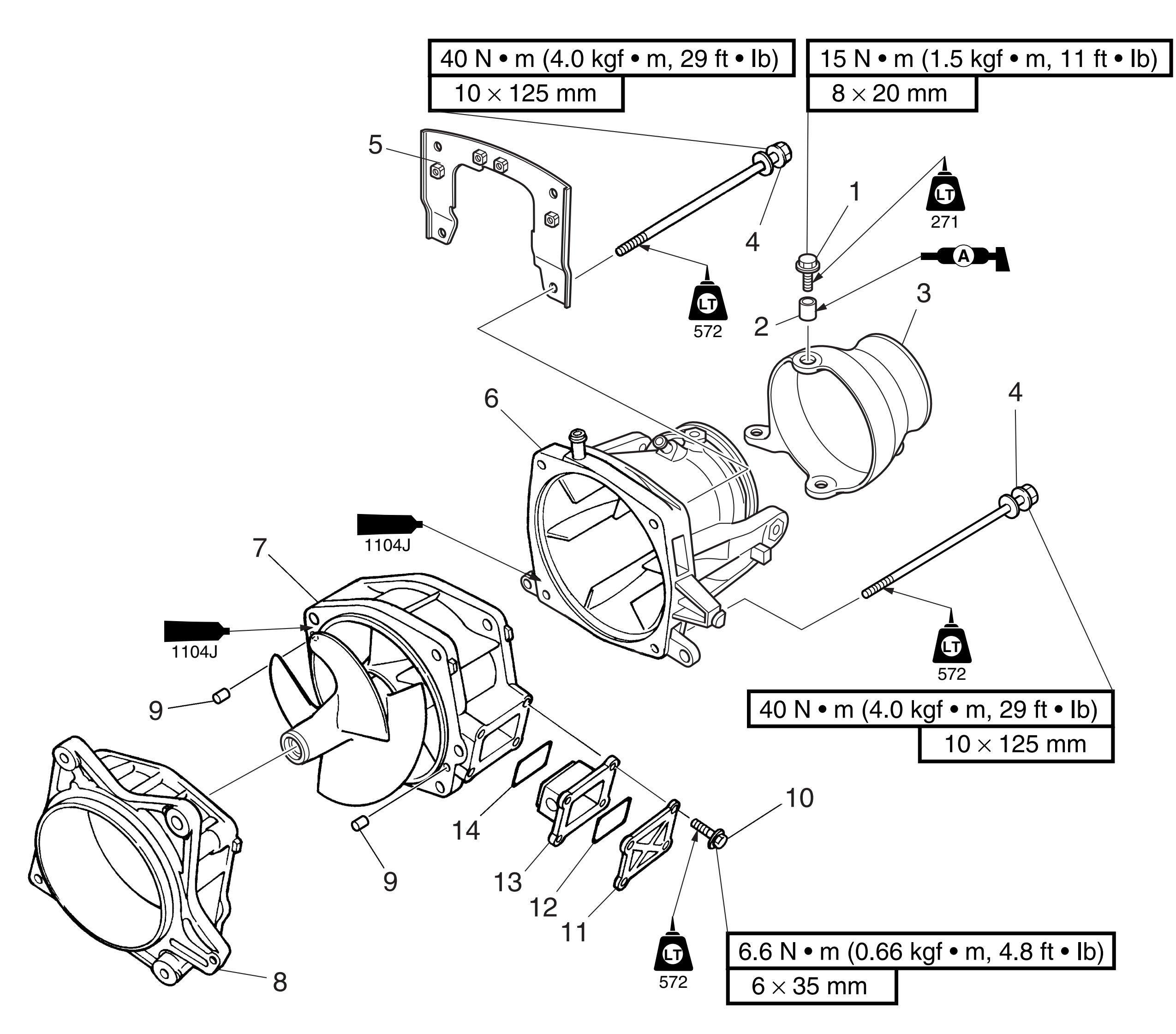
# REVERSE GATE (DELUXE MODEL ONLY)
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **REVERSE GATE REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Hose clamp/spout hose | 1/1 | |
| 2 | Bolt | 2 | |
| 3 | Collar | 2 | |
| 4 | Reverse gate | 1 | |
| 5 | Spring | 1 | |
| 6 | Nut | 1 | |
| 7 | Washer | 1 | |
| 8 | Bolt | 1 | |
| 9 | Collar | 1 | |
| | | | Reverse the removal steps for installation. |

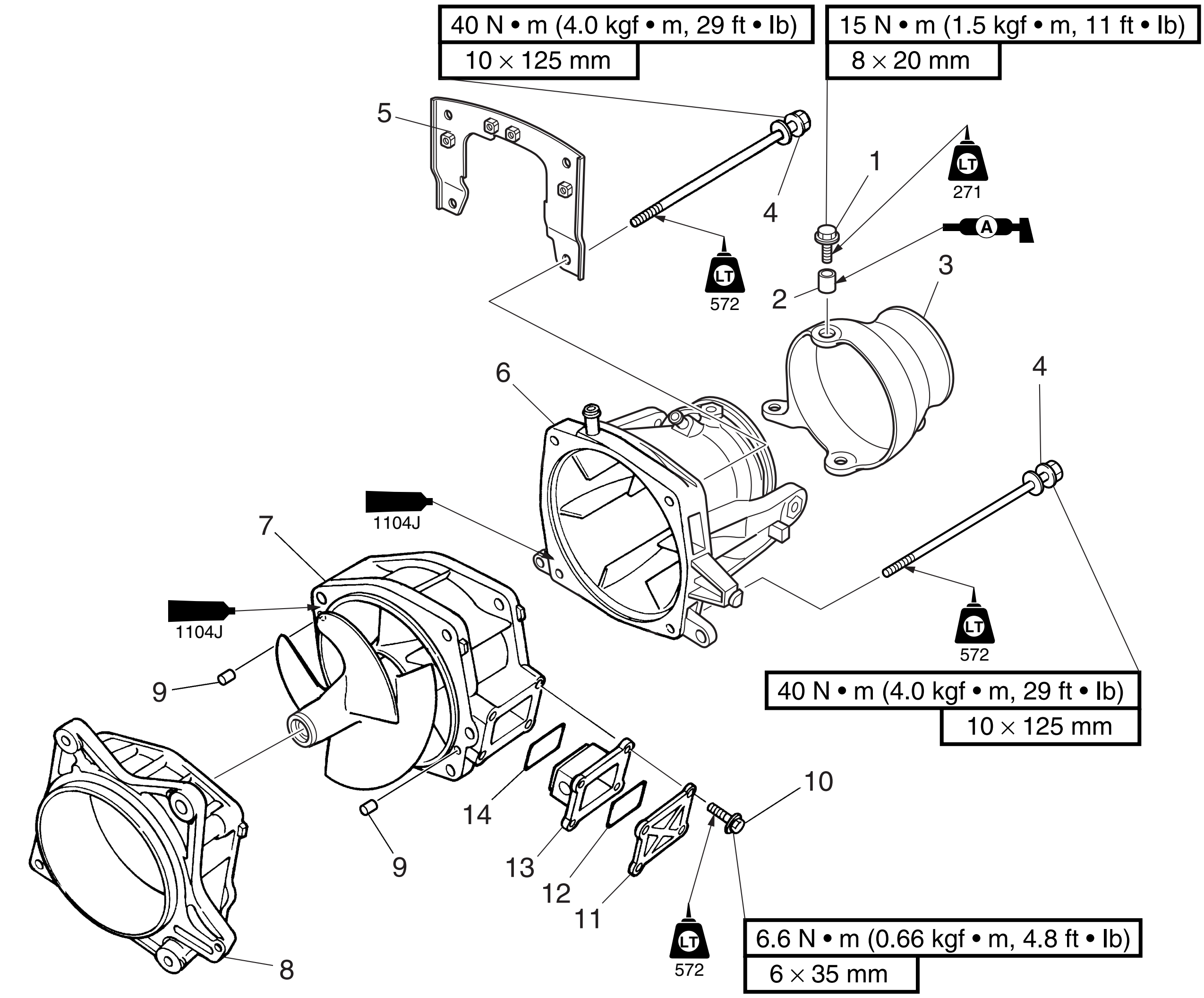
# JET THRUST NOZZLE, IMPELLER DUCT, AND IMPELLER HOUSING 1
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

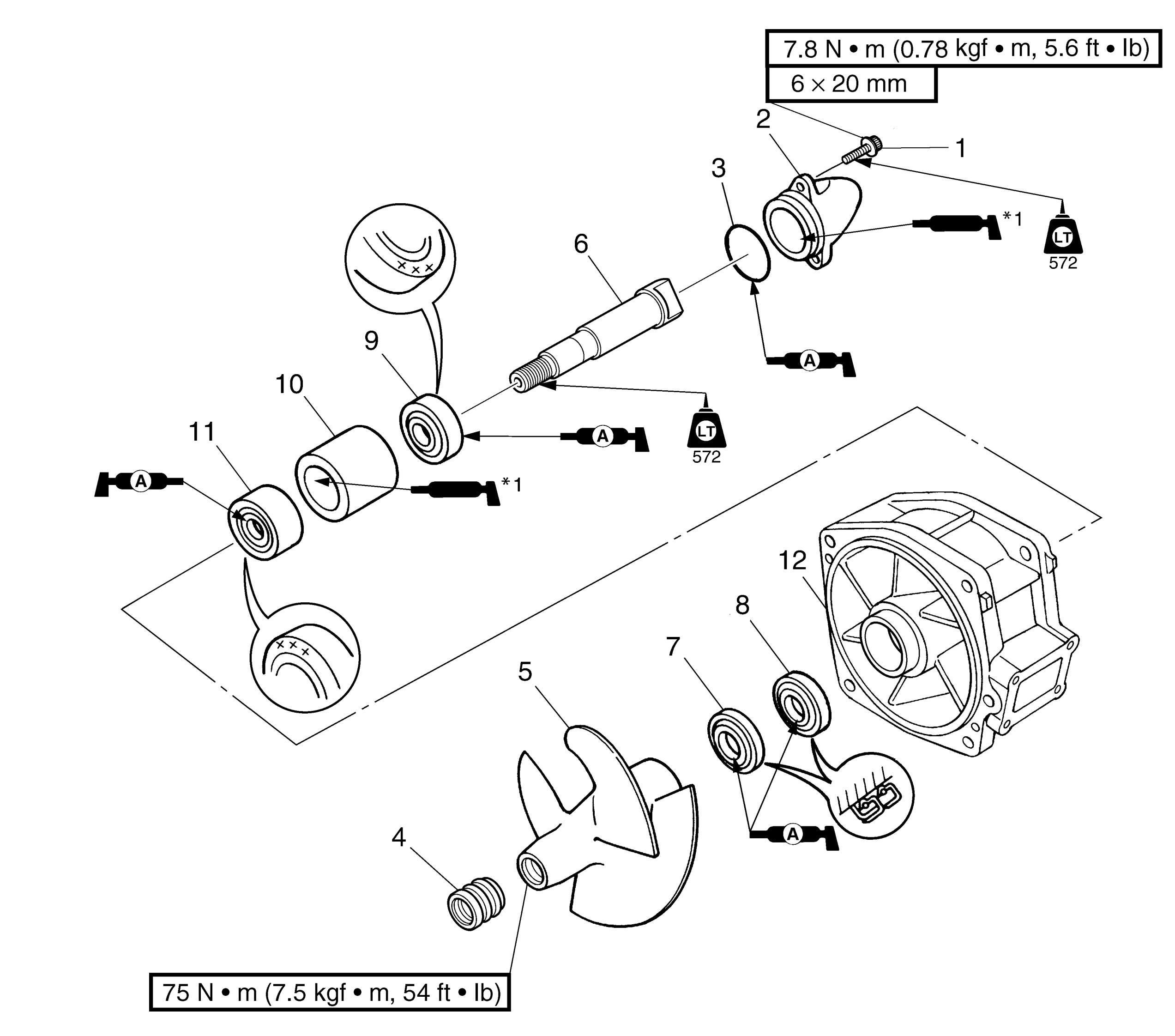
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **JET THRUST NOZZLE, IMPELLER DUCT, AND IMPELLER HOUSING 1 REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Bolt | 2 | |
| 2 | Collar | 2 | |
| 3 | Jet thrust nozzle | 1 | |
| 4 | Bolt | 4 | |
| 5 | Bracket | 1 | |
| 6 | Nozzle | 1 | **NOTE:** |
| 7 | Impeller duct assembly | 1 | Clean the contacting surfaces before applying the sealant. |
| 8 | Impeller housing 1 | 1 | |
| 9 | Pin | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 10 | Bolt | 4 | |
| 11 | Water inlet cover | 1 | |
| 12 | Packing | 1 | |
| 13 | Water inlet strainer | 1 | |
| 14 | Packing | 1 | |
| | | | Reverse the removal steps for installation. |

# IMPELLER DUCT AND DRIVE SHAFT
## EXPLODED DIAGRAM

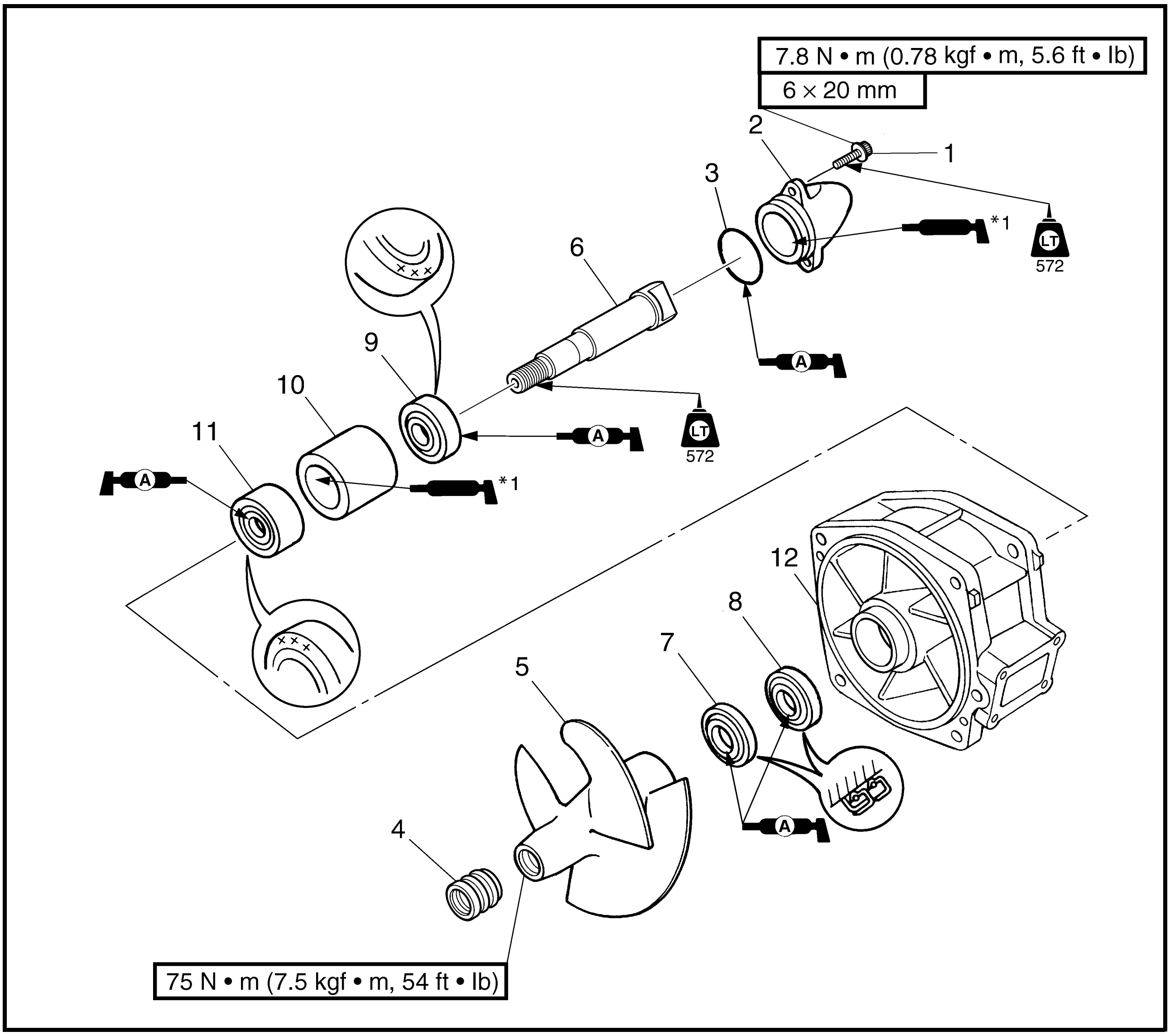



## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **IMPELLER DUCT AND DRIVE SHAFT DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Bolt | 3 | |
| 2 | Cap | 1 | |
| 3 | O-ring | 1 | **Not reusable** |
| 4 | Cap | 1 | |
| 5 | Impeller | 1 | |
| 6 | Drive shaft | 1 | |
| 7 | Oil seal | 1 | **Not reusable** |

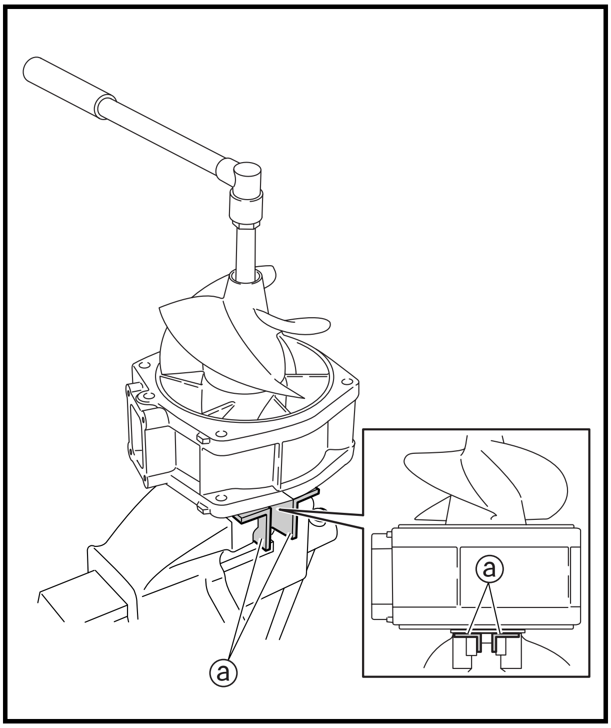
*1: EPNOC grease AP #0

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Oil seal | 1 | **Not reusable** |
| 9 | Rear bearing | 1 | **Not reusable** |
| 10 | Spacer | 1 | |
| 11 | Front bearing | 1 | **Not reusable** |
| 12 | Impeller duct | 1 | |
| | | | Reverse the disassembly steps for assembly. |

*1: EPNOC grease AP #0



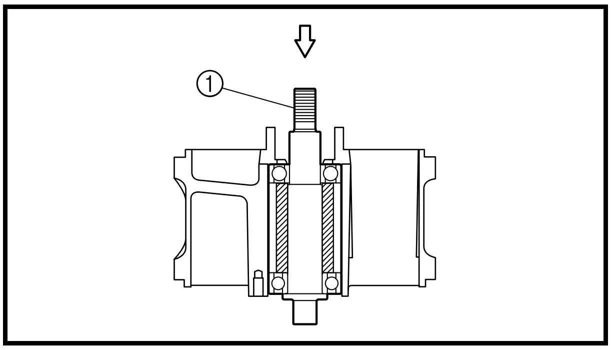

## SERVICE POINTS

### Drive shaft removal

1. Remove:
   - Impeller

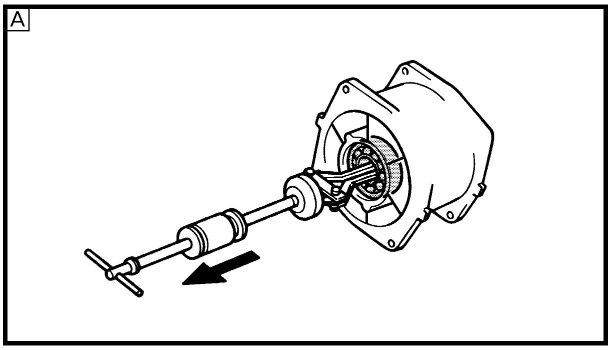
**NOTE:**
Hold the impeller duct assembly in a vise between two aluminum plates ⓐ.

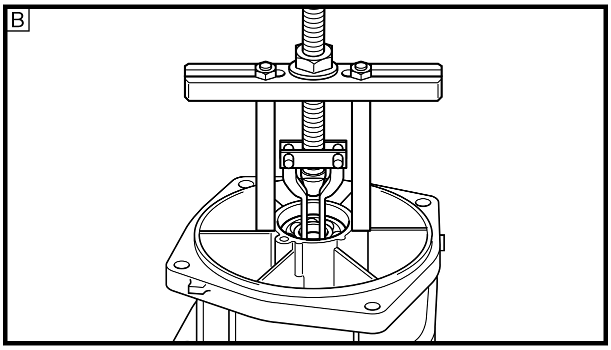
**Crankshaft holder:**
**YB-06552**
**Crankshaft holder 20:**
**90890-06552**




2. Remove:
   - Drive shaft ①

**NOTE:**
Remove the drive shaft using a press.

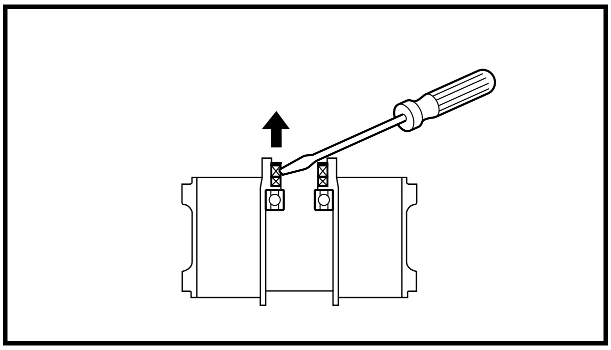



3. Remove:
   - Rear bearing

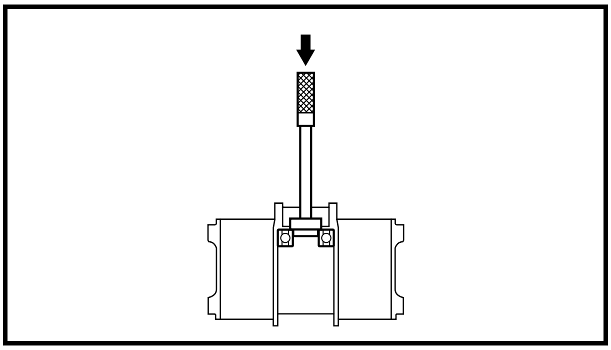
**Slide hammer and adapters:**
**YB-06096**
**Stopper guide plate:**
**90890-06501**
**Bearing puller assembly:**
**90890-06535**
**Stopper guide stand:**
**90890-06538**

A For USA and Canada
B For worldwide

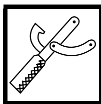


4. Remove:
   - Oil seals

**NOTE:**
Remove the oil seals using a flat head screw-driver.



5. Remove:
   - Front bearing



**Driver handle—large:**
**YB-06071**
**Driver rod L3:**
**90890-06652**
**Bearing housing needle bearing remover:**
**YB-06112**
**Needle bearing attachment:**
**90890-06614**

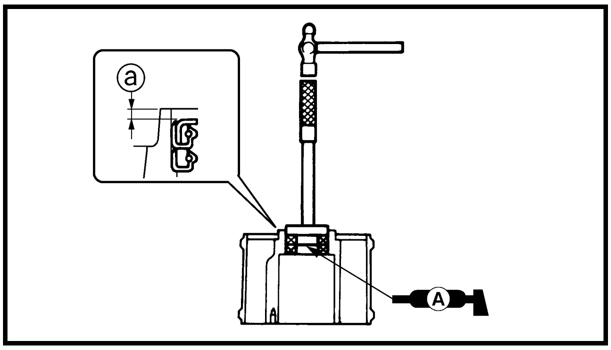
**NOTE:**
Remove the front bearing using a press.

**Impeller inspection**

Refer to “JET PUMP UNIT” in Chapter 3.

**Drive shaft inspection**

1. Inspect:
   - Drive shaft
     Damage/wear → Replace.

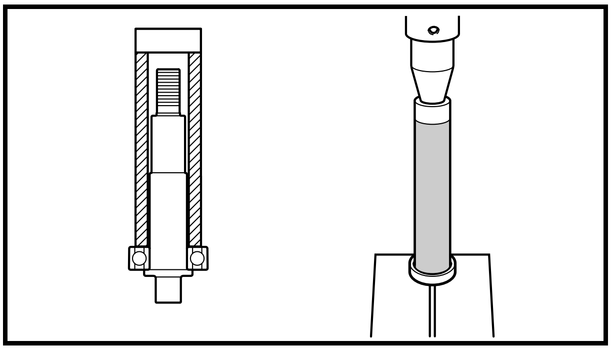



**Drive shaft installation**

1. Install:
   - Oil seals

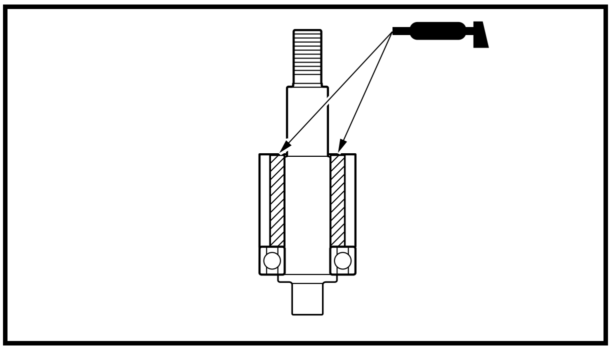
| | |
|---|---|
| | **Driver handle—large:**<br>**YB-06071**<br>**Driver rod LS:**<br>**90890-06606**<br>**Outer race installer—forward gear:**<br>**YB-06085**<br>**Ball bearing attachment:**<br>**90890-06634** |

| | |
|---|---|
| | **Distance ⓐ:**<br>**4.6 ± 0.2 mm (0.18 ± 0.01 in)** |



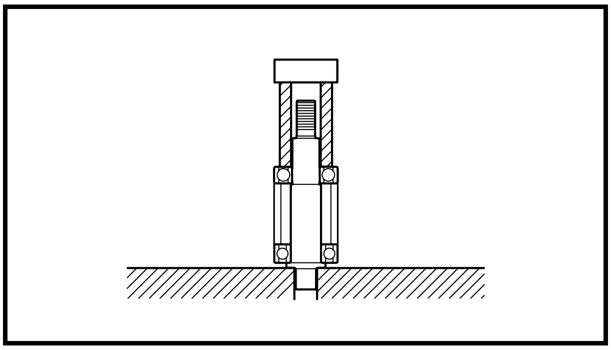
2. Install:
   - Rear bearing

**NOTE:**
- Install the rear bearing onto the drive shaft using a press.
- Press the rear bearing using a pipe that is more than 140 mm (5.51 in) long and that has an inner diameter of 26 mm (1.02 in).



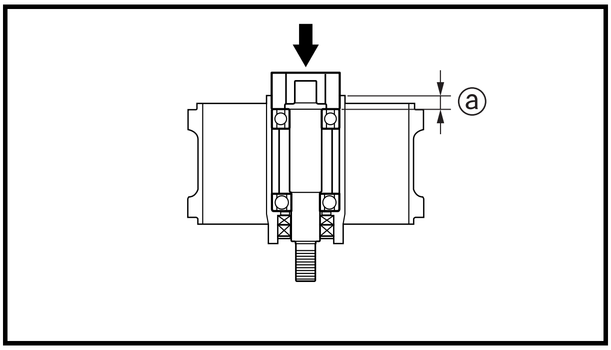
3. Install:
   - Spacer
4. Add:
   - EPNOC grease AP #0
     (between the drive shaft and spacer)

| | |
|---|---|
| | **Quantity:**<br>**20 g (0.7 oz)** |



5. Install:
   - Front bearing

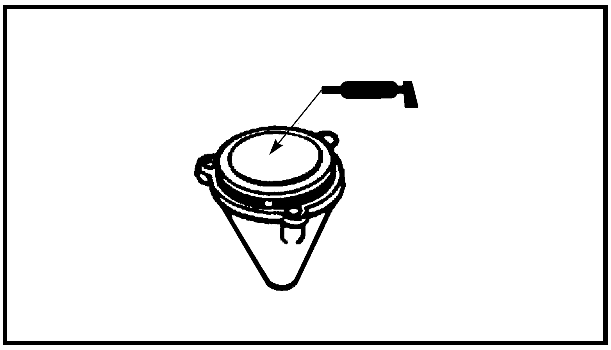
**NOTE:**
Press the spacer and the front bearing using a pipe that is more than 60 mm (2.36 in) long and that has an inner diameter more than 26 mm (1.02 in).




6. Install:
   - Drive shaft (with front bearing spacer and rear bearing)

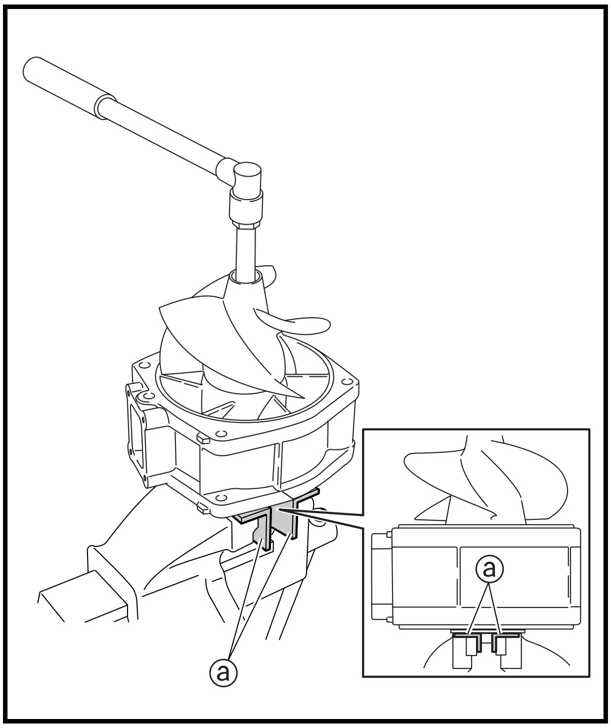
**Distance ⓐ:**
**11.7 ± 0.2 mm (0.46 ± 0.01 in)**

**NOTE:**
Press the rear bearing using a washer or pipe that has an outer diameter of 50 mm (1.97 in) and an inner diameter of 33 mm (1.30 in).



7. Add:
   - EPNOC grease AP #0 (into the cap)

**Quantity:**
**20 g (0.7 oz)**



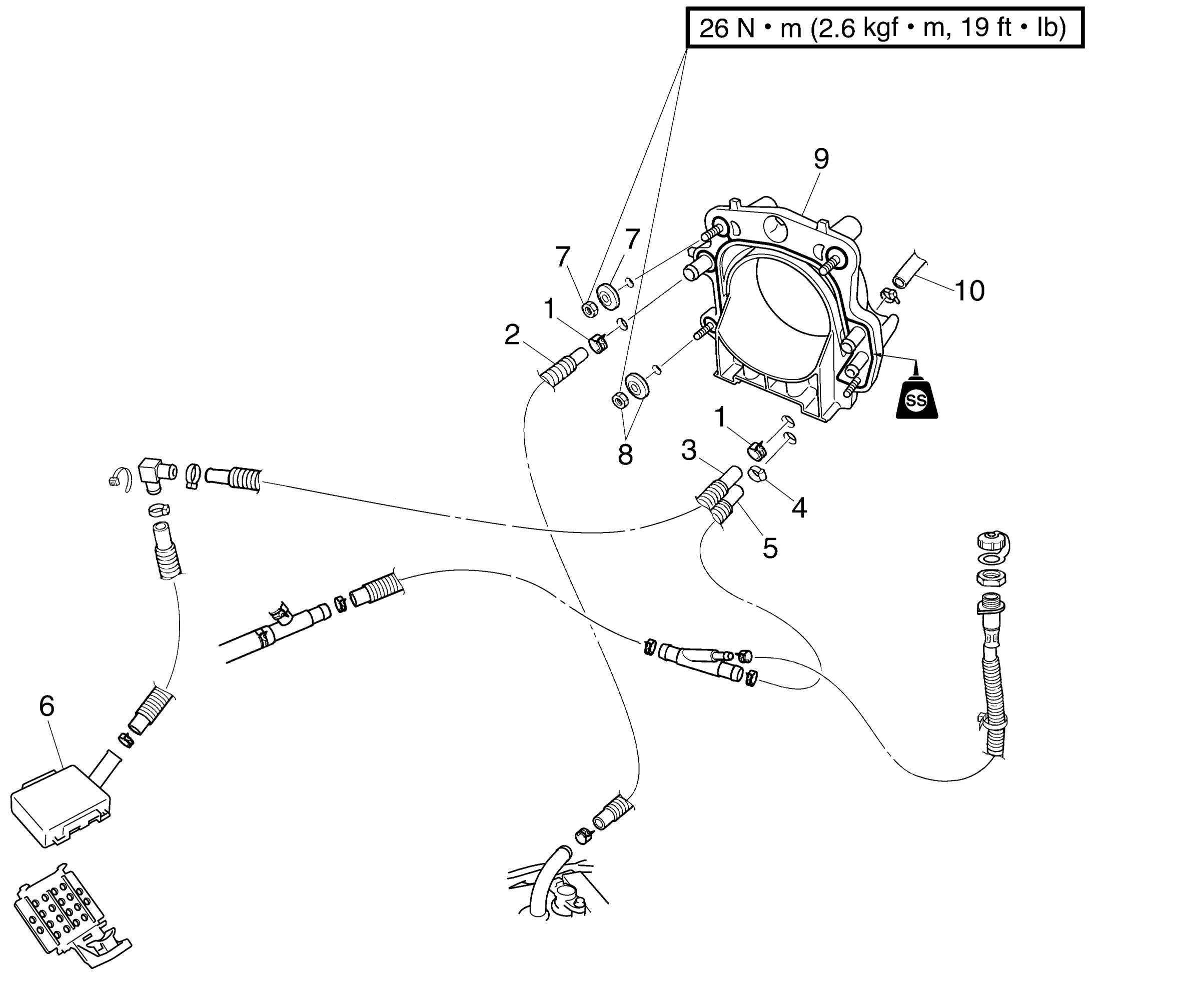

8. Install:
   - Impeller

**NOTE:**
Hold the impeller duct assembly in a vise between two aluminum plates ⓐ.

**Impeller:**
**75 N • m (7.5 kgf • m, 54 ft • lb)**
**LOCTITE 572**

**Crankshaft holder:**
**YB-06552**
**Crankshaft holder 20:**
**90890-06552**

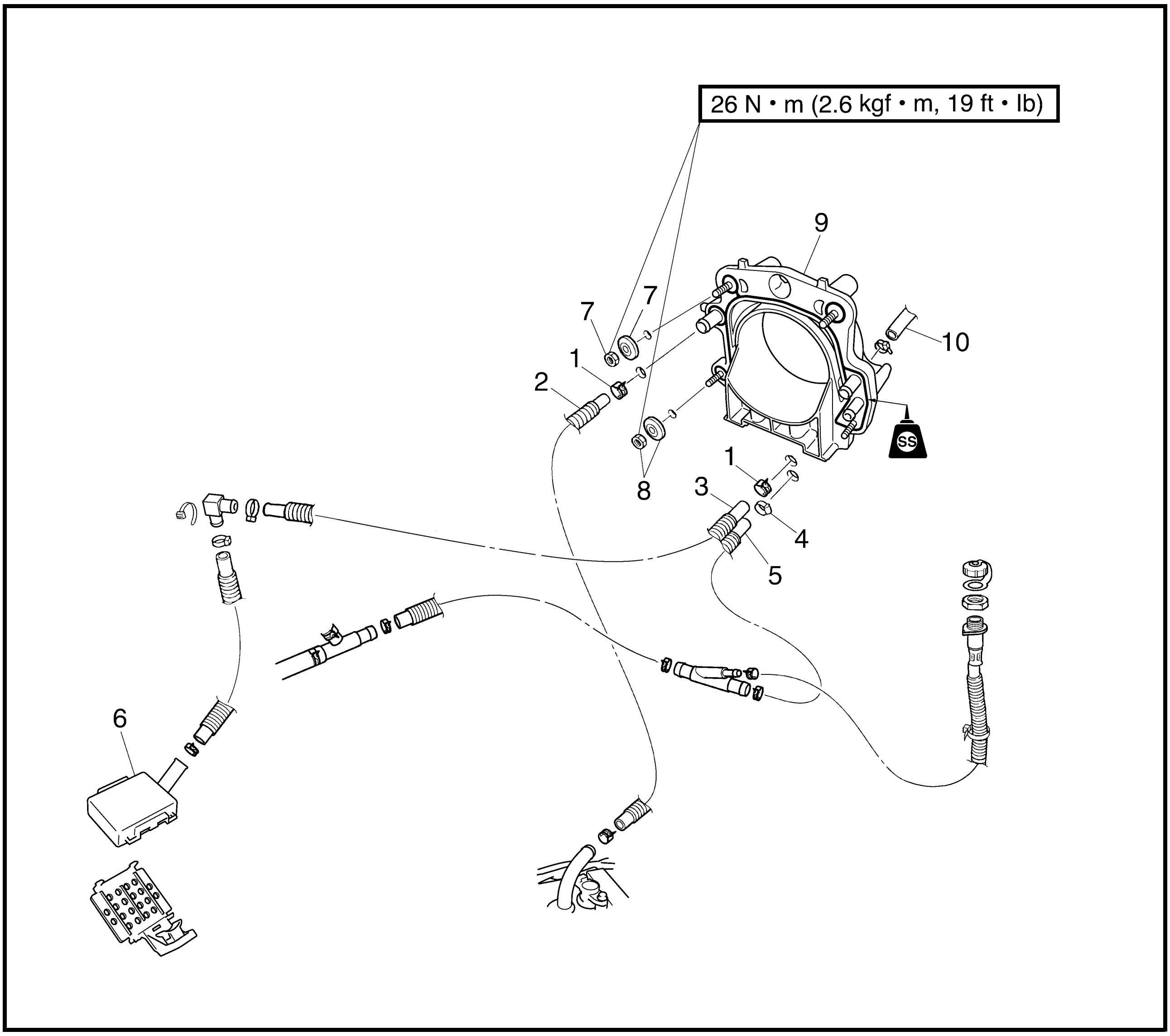
# TRANSOM PLATE AND HOSES
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **TRANSOM PLATE AND HOSES REMOVAL** | | Follow the left "Step" for removal. |
| | Exhaust system | | Refer to "EXHAUST SYSTEM" in Chapter 8. |
| | Jet pump unit assembly | | Refer to "JET PUMP UNIT". |
| 1 | Hose clamp | 2 | |
| 2 | Cooling water hose | 1 | Cooling water outlet (cylinder head) |
| 3 | Bilge hose 1 | 1 | |
| 4 | Hose clamp | 1 | |
| 5 | Cooling water hose | 1 | Cooling water inlet |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 6 | Bilge strainer | 1 | |
| 7 | Nut/washer | 2/2 | |
| 8 | Nut/washer | 2/2 | |
| 9 | Transom plate | 1 | |
| 10 | Bilge hose 2 | 1 | |
| | | | Reverse the removal steps for installation. |

## SERVICE POINTS

### Bilge strainer inspection

Refer to “JET PUMP UNIT” in Chapter 3.

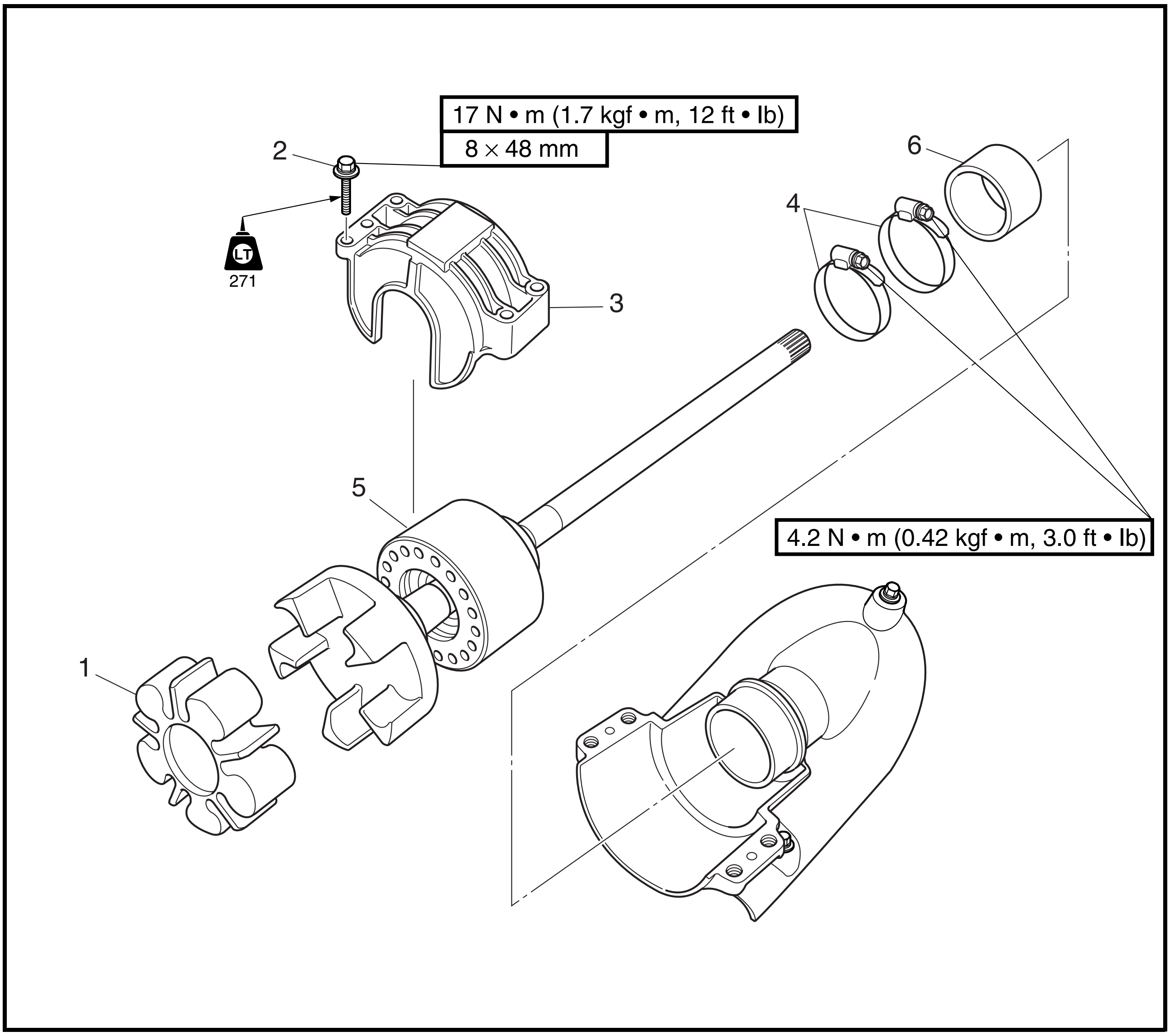
### Bilge hose inspection

1. Inspect:
   - Bilge hoses
     Cracks/damage/wear → Replace.

### Cooling water hose inspection

1. Inspect:
   - Cooling water hoses
     Cracks/damage/wear → Replace.

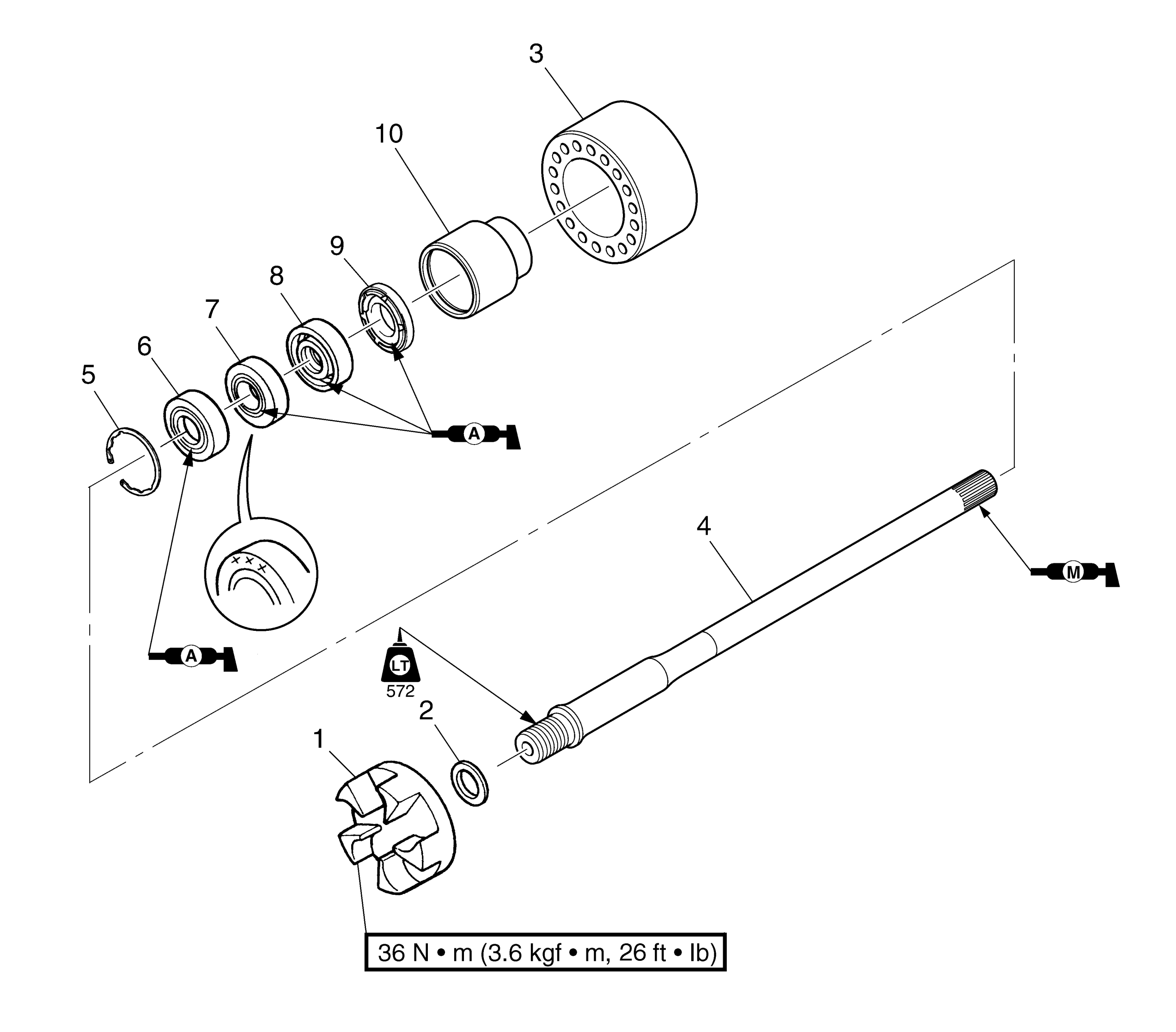
# BEARING HOUSING
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **BEARING HOUSING REMOVAL** | | Follow the left "Step" for removal. |
| | Engine unit | | Refer to "ENGINE UNIT" in Chapter 5. |
| 1 | Rubber coupling | 1 | |
| 2 | Bolt | 4 | |
| 3 | Intermediate housing cover | 1 | |
| 4 | Clamp | 2 | |
| 5 | Intermediate drive shaft assembly | 1 | |
| 6 | Rubber hose | 1 | |
| | | | Reverse the removal steps for installation. |

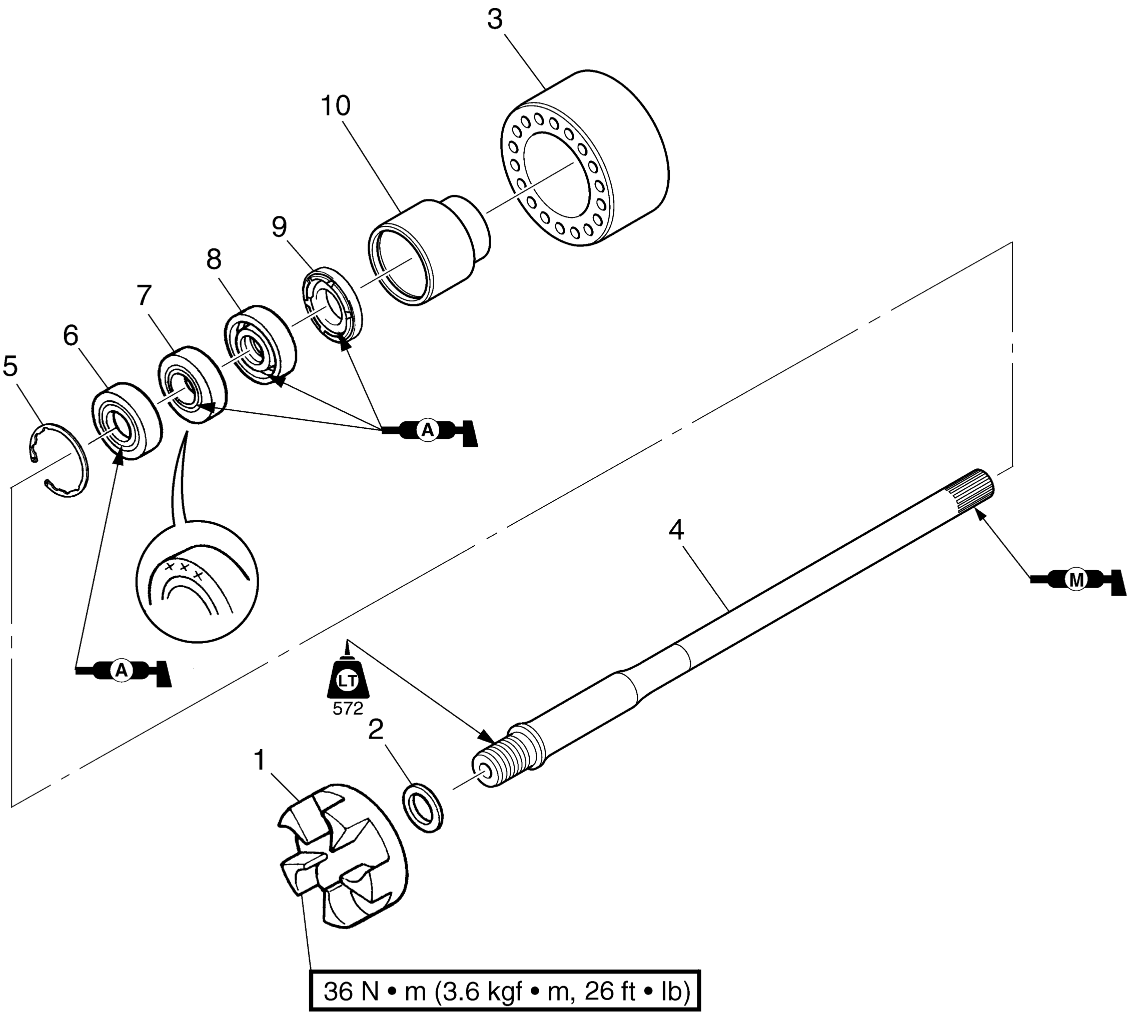
## EXPLODED DIAGRAM



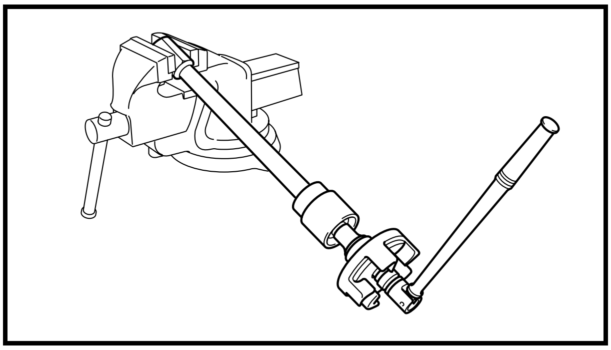

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **BEARING HOUSING DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Driven coupling | 1 | |
| 2 | Washer | 1 | |
| 3 | Damper | 1 | |
| 4 | Intermediate drive shaft | 1 | |
| 5 | Circlip | 1 | **Not reusable** |

## EXPLODED DIAGRAM



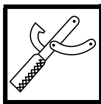

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 6 | Oil seal | 1 | **Not reusable** |
| 7 | Bearing | 1 | **Not reusable** |
| 8 | Oil seal | 1 | **Not reusable** |
| 9 | Oil seal | 1 | **Not reusable** |
| 10 | Bearing housing | 1 | |
| | | | Reverse the disassembly steps for assembly. |



## SERVICE POINTS

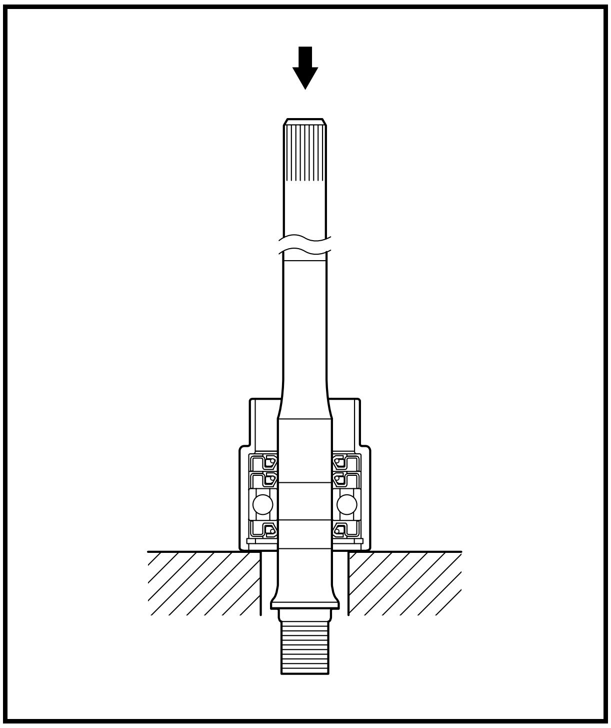
### Driven coupling removal and installation

1. Remove and install:
   - Driven coupling



**Coupler wrench:**
**YW-06551/90890-06551**
**Drive shaft holder:**
**YB-06151**
**Drive shaft holder 5:**
**90890-06519**

**NOTE:**
- Install the driven coupling using the same special tools that were used for removal.
- Check that the drive shaft holder and intermediate drive shaft are properly engaged.

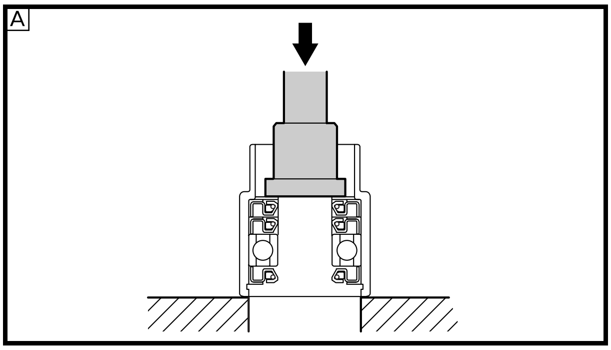


### Intermediate drive shaft removal

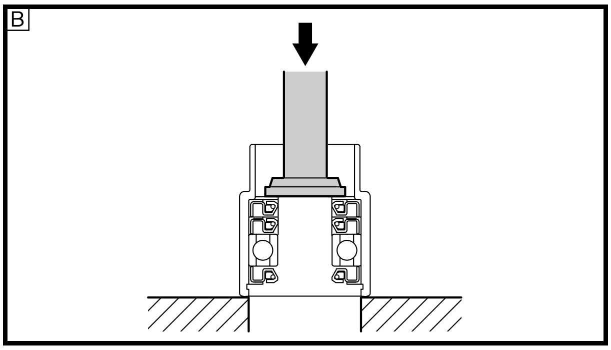
1. Remove:
   - Intermediate drive shaft

**NOTE:**
Remove the intermediate drive shaft using a press.

A



B



**Bearing removal**

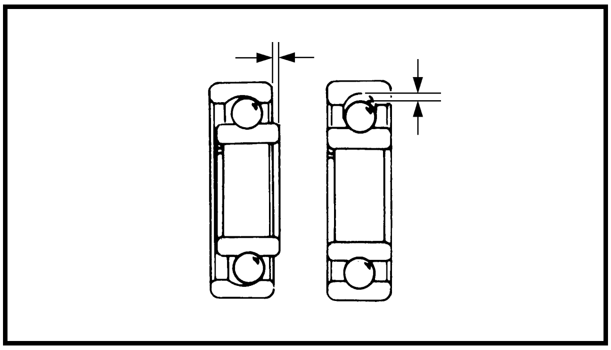
1. Remove:
   - Circlip
   - Bearing
   - Oil seals

**Driver handle—large:**
**YB-06071**
**Driver rod LS:**
**90890-06606**
**Roller bearing installer/remover:**
**YB-06432**
**Bearing outer race attachment:**
**90890-06628**

A For USA and Canada
B For worldwide

**NOTE:**

Remove the bearing and oil seals using a press.

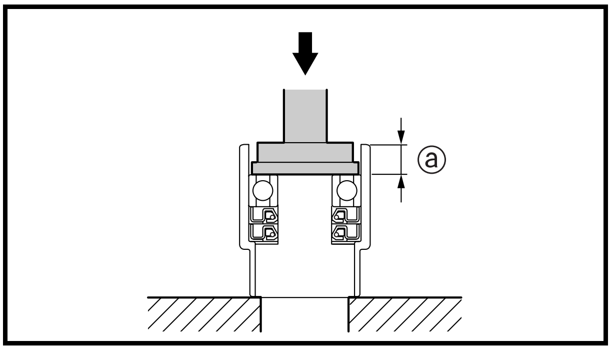


**Bearing and intermediate drive shaft inspection**

1. Inspect:
   - Bearing
     Rotate the inner race by hand.
     Damage/rough movement → Replace.
   - Intermediate drive shaft
     Damage/pitting → Replace.

**Driven coupling inspection**

1. Inspect:
   - Driven coupling
   - Driven coupling damper
     Damage/wear → Replace.



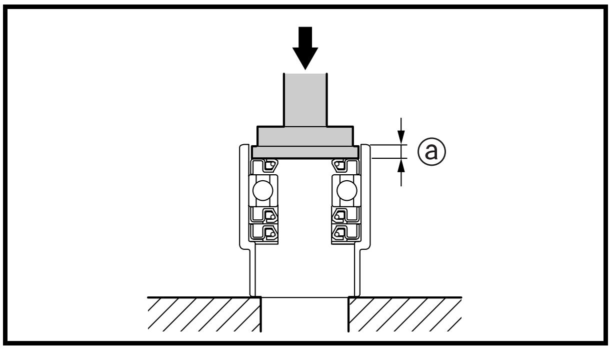

**Bearing and oil seals installation**

1. Install:
   - Oil seals
   - Bearing

**NOTE:**
Install the bearing using a press.

**Driver handle—large:**
**YB-06071**
**Driver rod LS:**
**90890-06606**
**Outer race installer—forward gear:**
**YB-06085**
**Ball bearing attachment:**
**90890-06631**

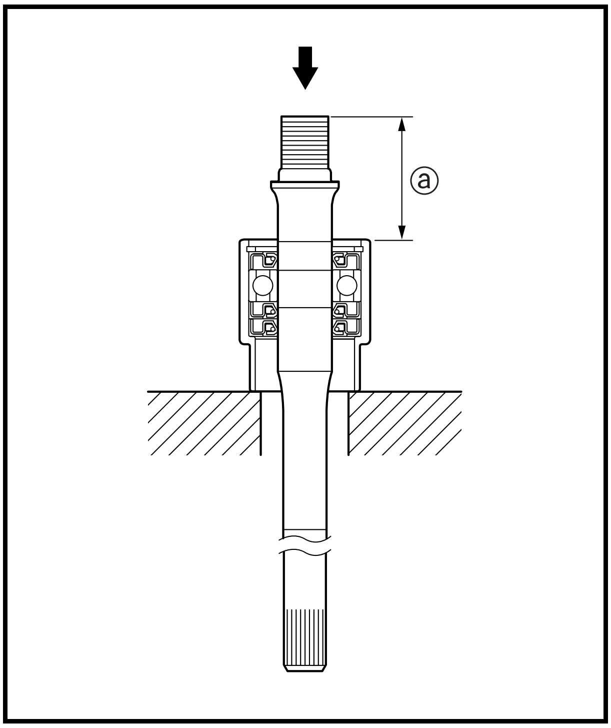
**Distance ⓐ:**
**14.2 ± 0.2 mm (0.56 ± 0.01 in)**




2. Install:
   - Oil seal

**Driver handle—large:**
**YB-06071**
**Driver rod LS:**
**90890-06606**
**Outer race installer—forward gear:**
**YB-06085**
**Ball bearing attachment:**
**90890-06631**

**Distance ⓐ:**
**6.2 ± 0.2 mm (0.24 ± 0.01 in)**




### Intermediate drive shaft installation

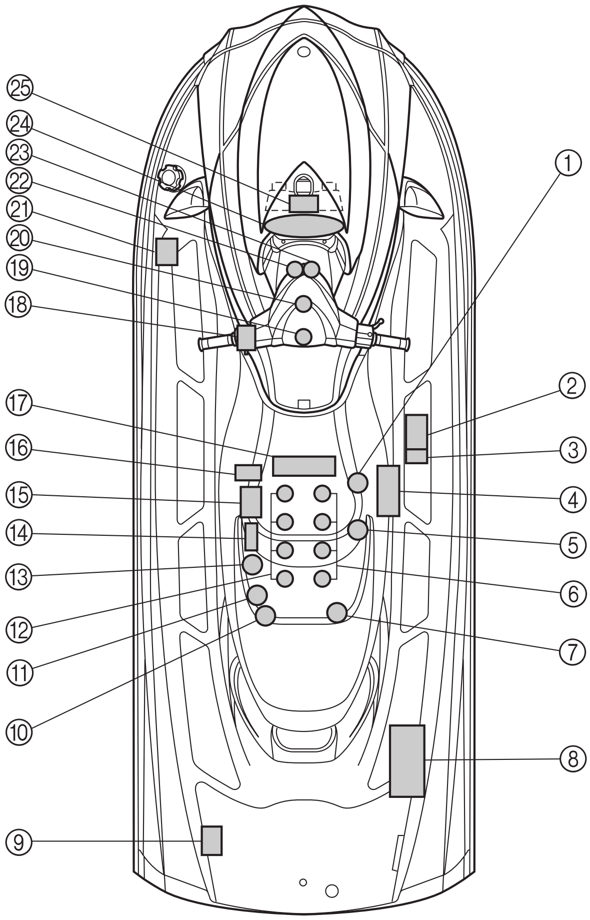
1. Install:
   - Intermediate drive shaft

**NOTE:**
Install the intermediate drive shaft using a press.

**Distance ⓐ:**
**56.8 ± 0.2 mm (2.24 ± 0.01 in)**

# CHAPTER 7
# ELECTRICAL SYSTEM

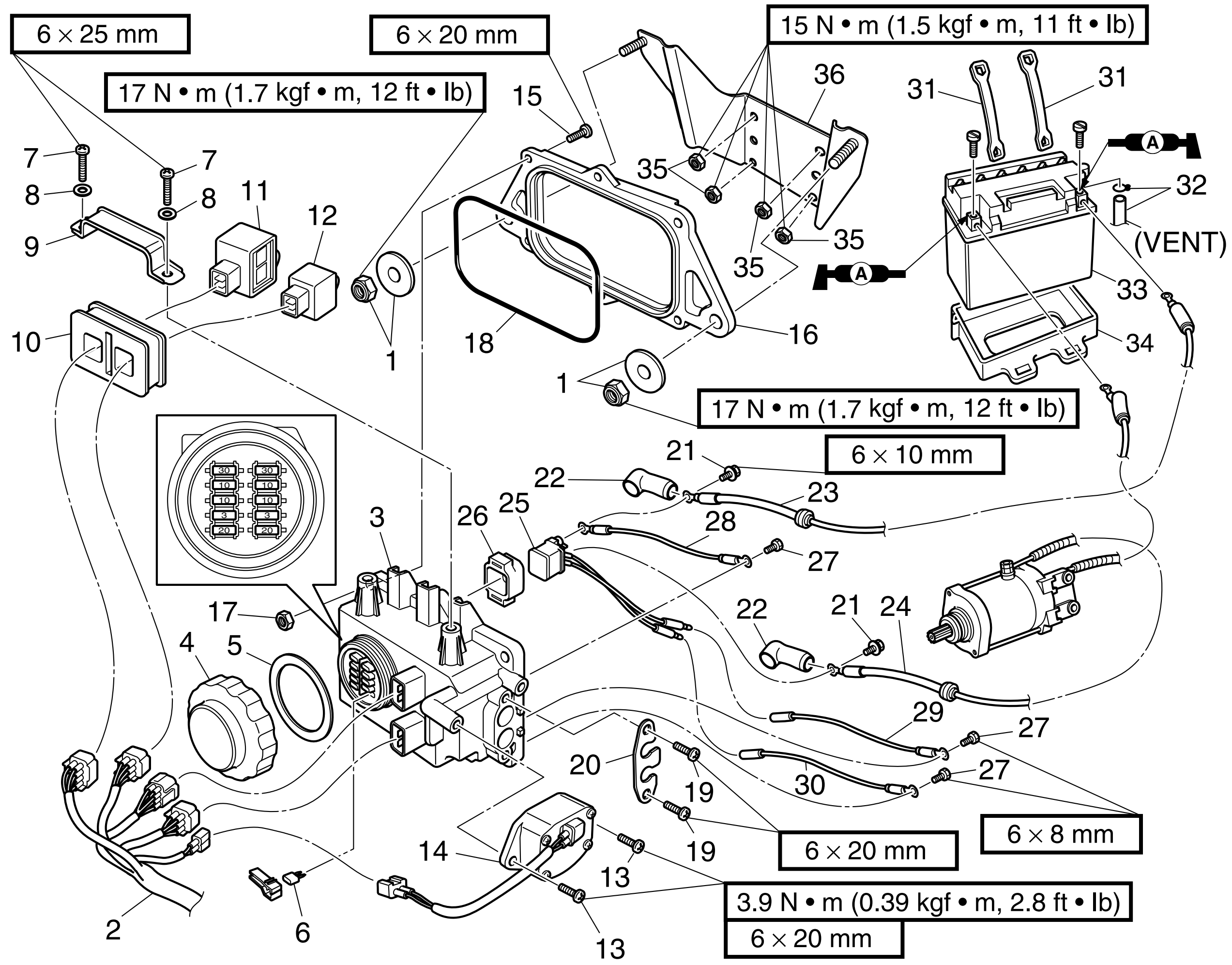
# ELECTRICAL COMPONENTS




① Thermoswitch (engine)
② Fuse box
③ Slant detection switch
④ Starter motor
⑤ Engine temperature sensor
⑥ Spark plugs and ignition coils
⑦ Cam position sensor
⑧ Battery
⑨ Speed sensor
⑩ Sensor assembly (intake air pressure and intake air temperature)
⑪ Oil pressure switch
⑫ Fuel injectors
⑬ Thermoswitch (exhaust)
⑭ Rectifier/regulator
⑮ ECM
⑯ Throttle body assembly
⑰ Lighting coil and pickup coil
⑱ Engine stop switch, engine shut-off switch, and start switch
⑲ Steering sensor
⑳ Buzzer
㉑ Accelerator position sensor
㉒ Electric fuel pump
㉓ Fuel sender
㉔ Multifunction meter
㉕ Remote control unit (Deluxe model only)

# FUSE BOX

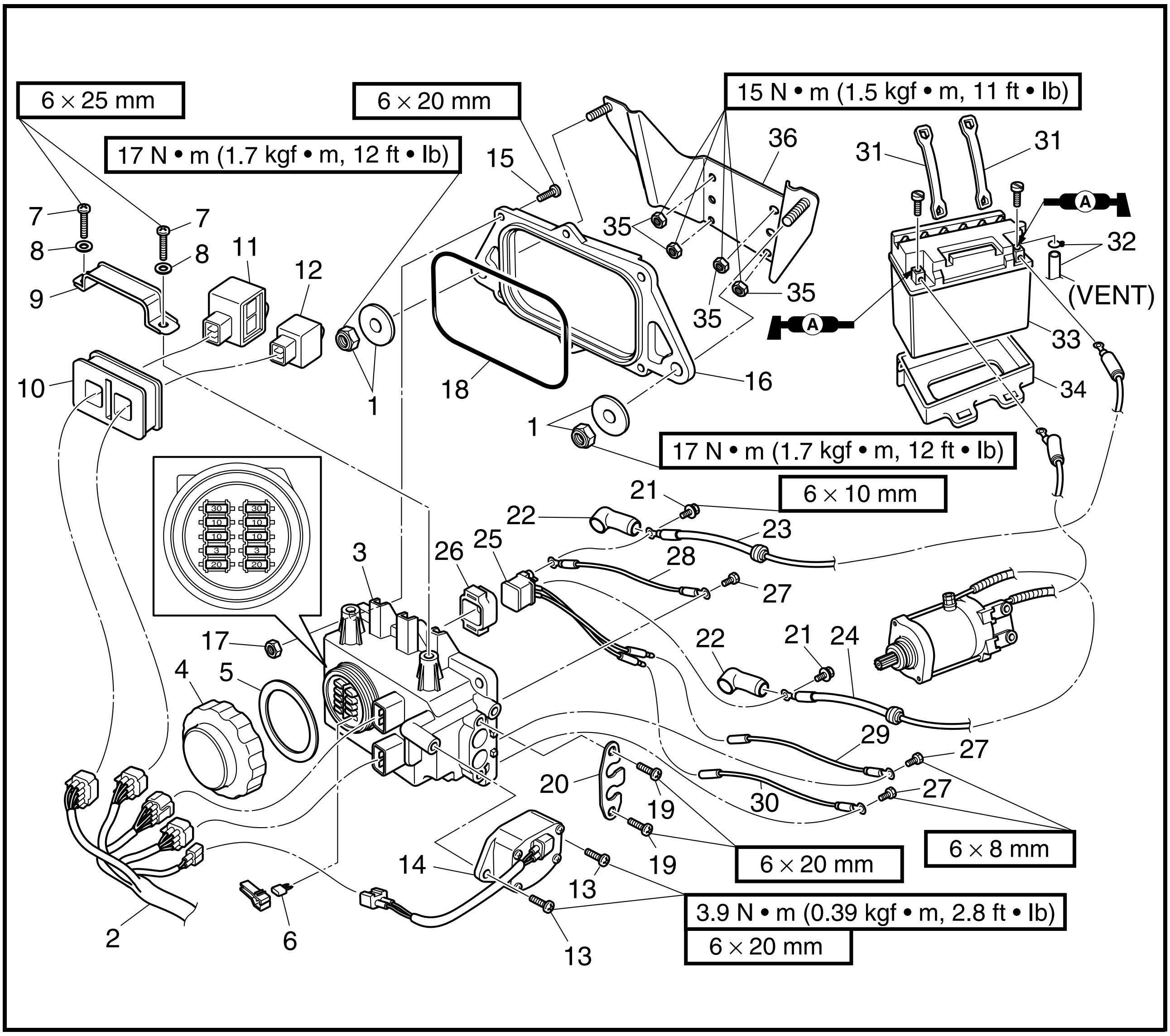
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

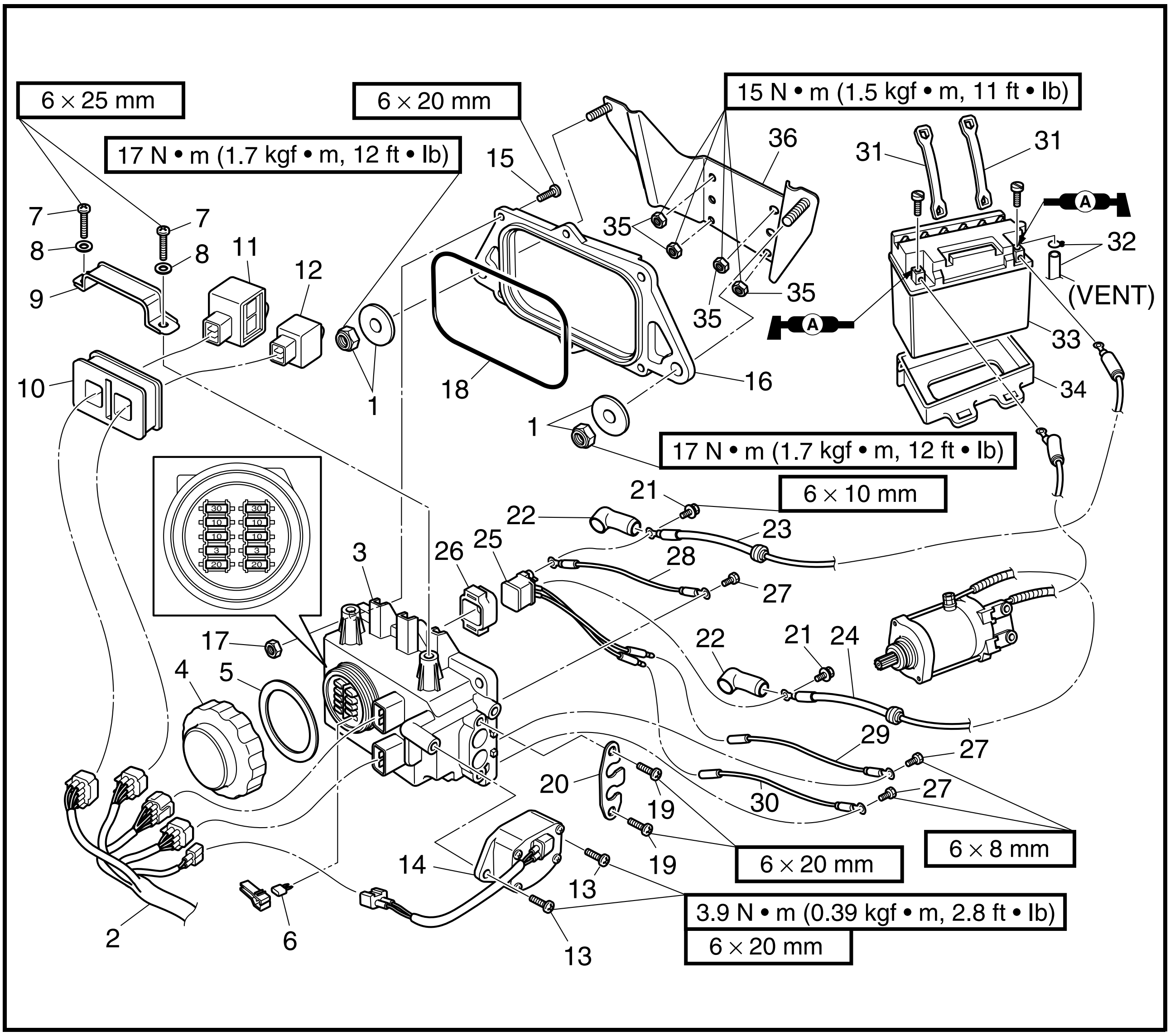
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **FUSE BOX REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Nut/washer | 2/2 | |
| 2 | Wiring harness | 1 | **NOTE:** Disconnect all couplers. |
| 3 | Fuse box | 1 | |
| 4 | Fuse box cap | 1 | |
| 5 | Gasket | 1 | **Not reusable** |
| 6 | Fuse | 10 | |
| 7 | Tapping screw | 2 | |
| 8 | Washer | 2 | |

## EXPLODED DIAGRAM



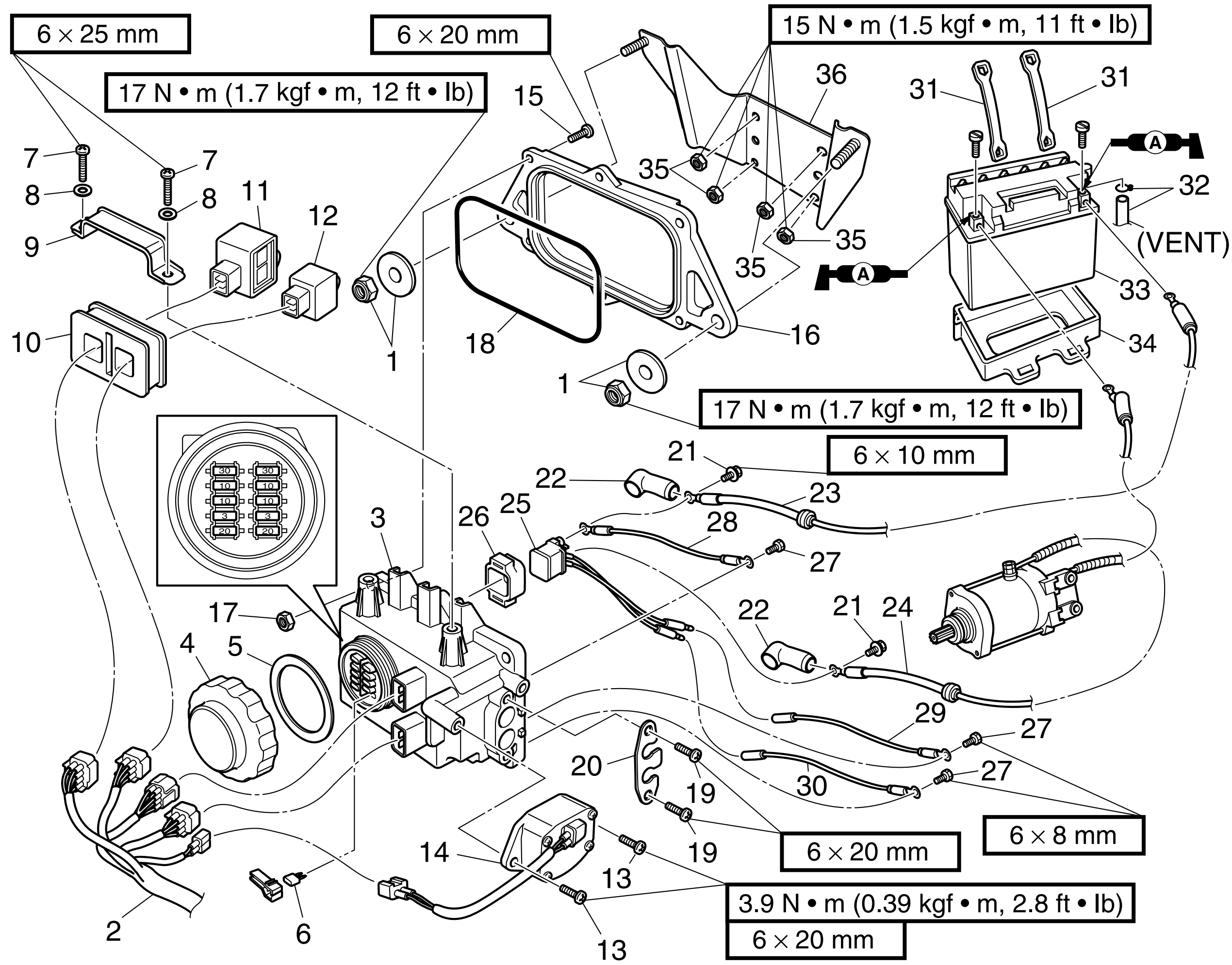

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 9 | Bracket | 1 | |
| 10 | Rubber mount | 1 | |
| 11 | Main and fuel pump relay | 1 | |
| 12 | Electronic control throttle valve relay | 1 | |
| 13 | Tapping screw | 2 | |
| 14 | Slant detection switch | 1 | |
| 15 | Bolt | 6 | |
| 16 | Fuse box cover | 1 | |
| 17 | Nut | 6 | |
| 18 | Gasket | 1 | **Not reusable** |
| 19 | Tapping screw | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 20 | Plate | 1 | |
| 21 | Bolt | 2 | |
| 22 | Cover | 2 | |
| 23 | Positive battery lead | 1 | |
| 24 | Starter motor lead | 1 | With white tape |
| 25 | Starter relay | 1 | |
| 26 | Grommet | 1 | |
| 27 | Bolt | 3 | |
| 28 | Wiring harness | 1 | Red |
| 29 | Wiring harness | 1 | Brown |

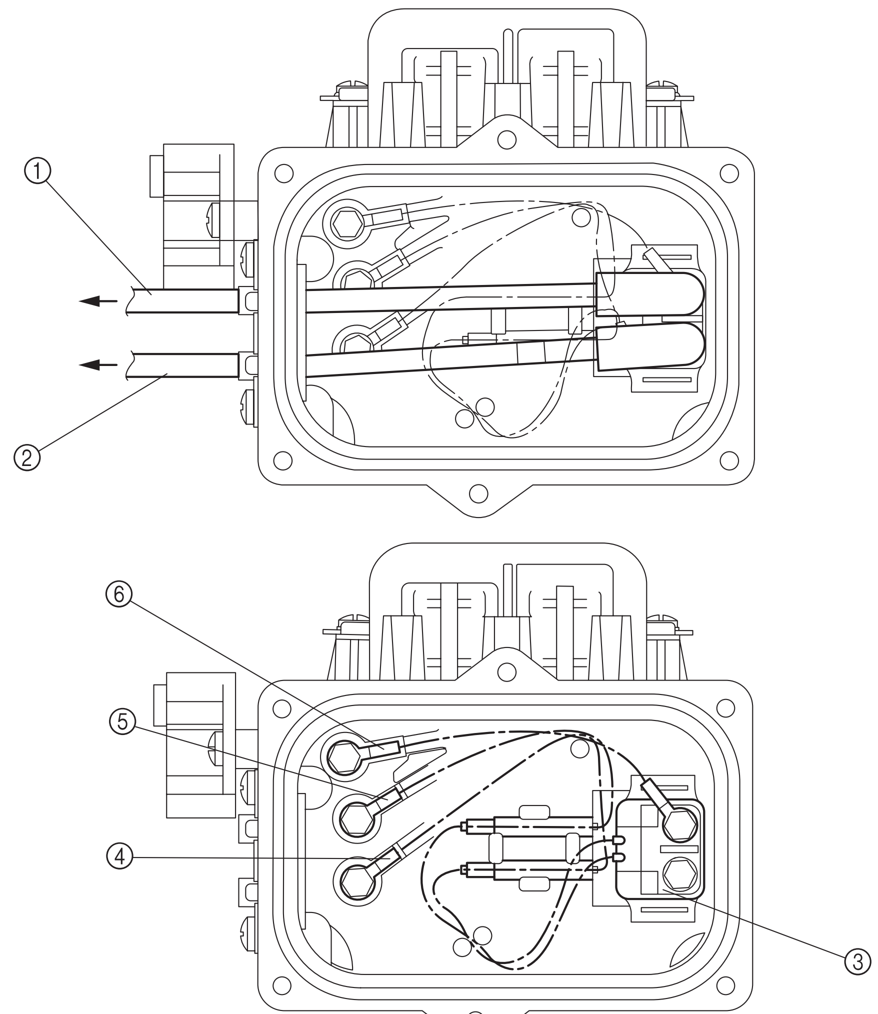
## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 30 | Wiring harness | 1 | Black |
| 31 | Holder | 2 | |
| 32 | Pipe | 1 | |
| 33 | Battery | 1 | |
| 34 | Battery box | 1 | |
| 35 | Nut | 4 | |
| 36 | Holder | 1 | |
| | | | Reverse the removal steps for installation. |

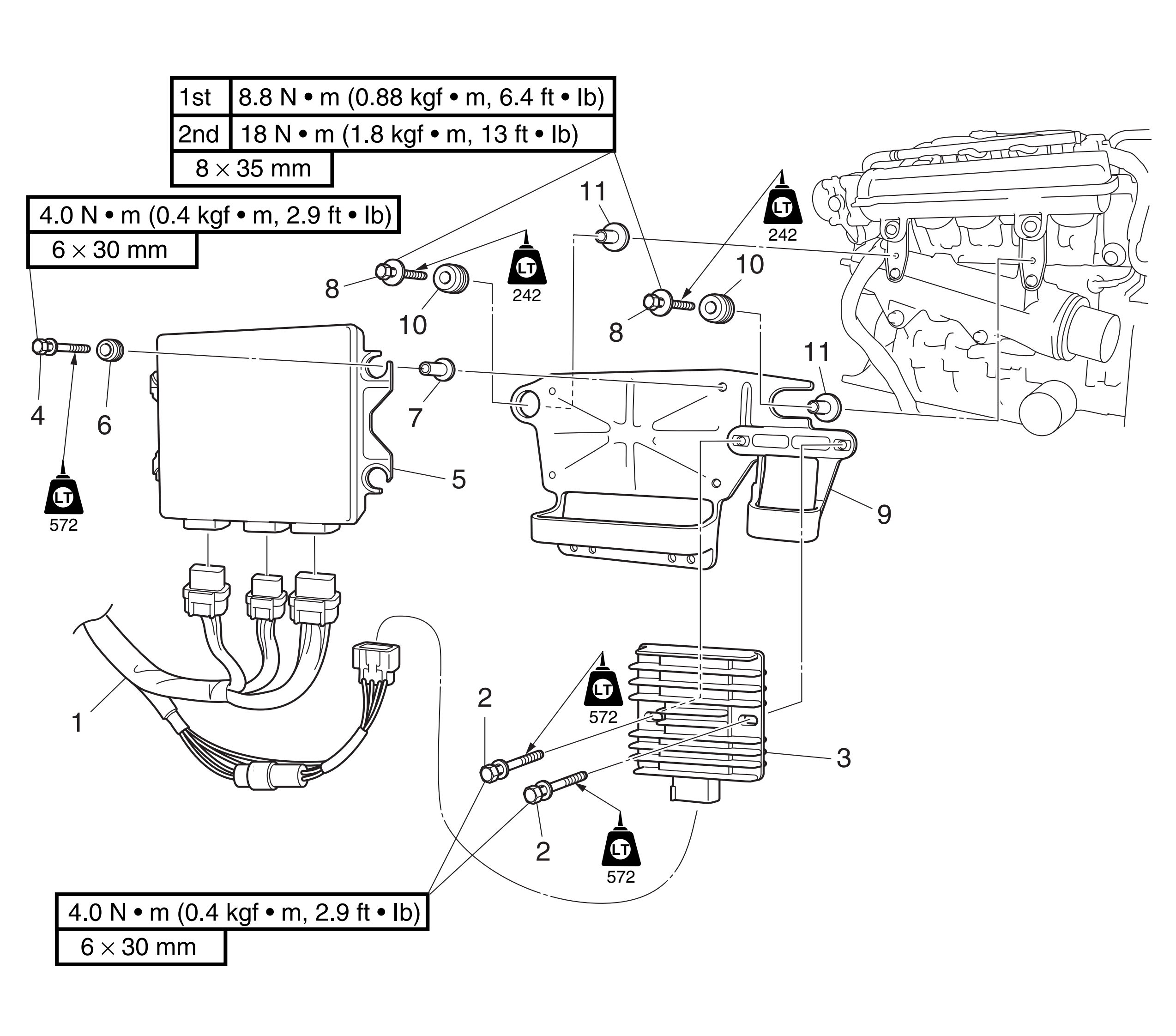
# FUSE BOX






① Positive battery lead
② Starter motor lead (white tape)
③ Starter relay
④ Wiring harness (black)
⑤ Wiring harness (brown)
⑥ Wiring harness (red)

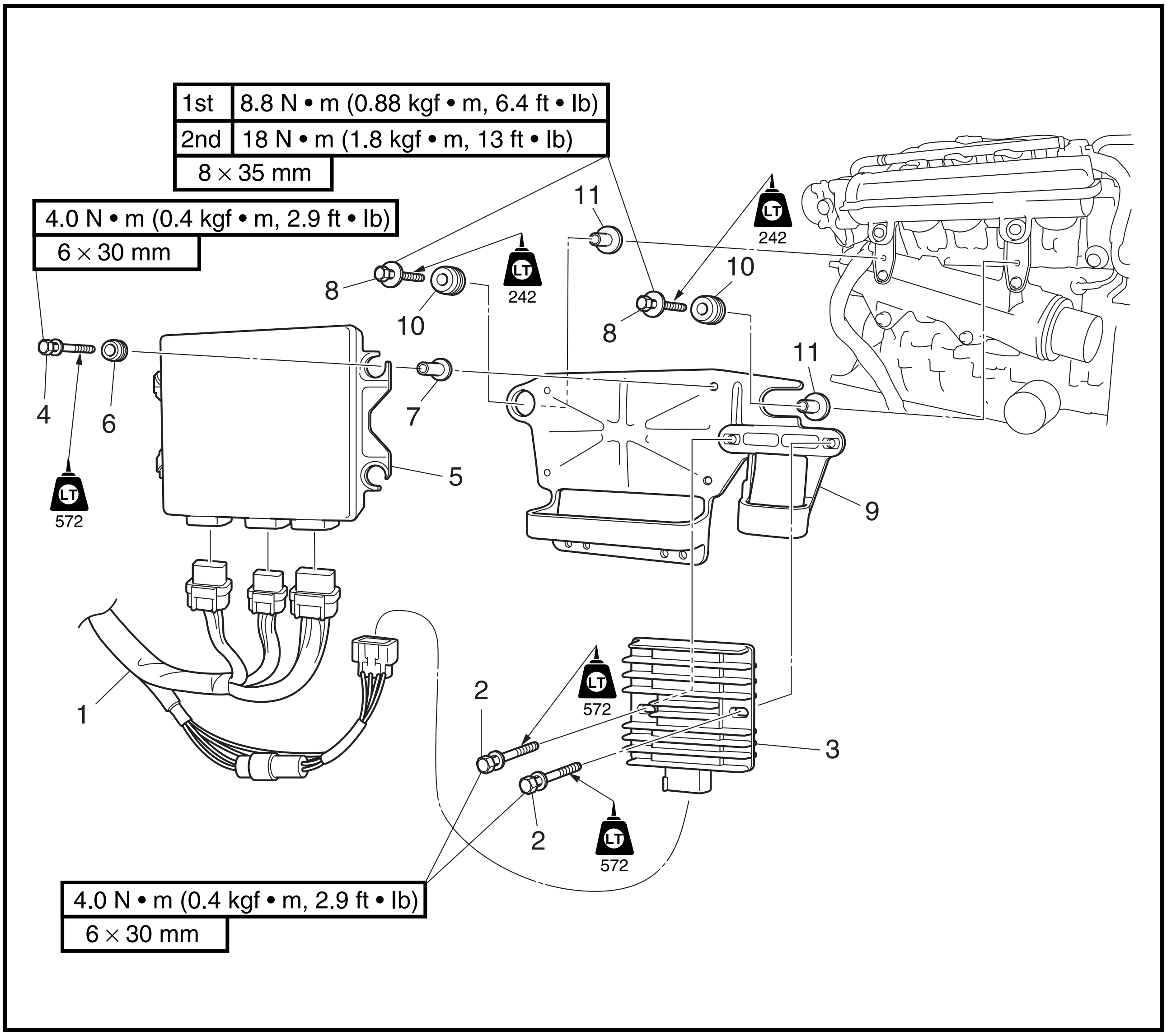
# ECM AND RECTIFIER/REGULATOR
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **ECM AND RECTIFIER/ REGULATOR REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Wiring harness | 1 | **NOTE:** Disconnect all couplers. |
| 2 | Bolt | 2 | |
| 3 | Rectifier/regulator | 1 | |
| 4 | Bolt | 4 | |
| 5 | ECM | 1 | |
| 6 | Grommet | 4 | |
| 7 | Collar | 4 | |

## EXPLODED DIAGRAM

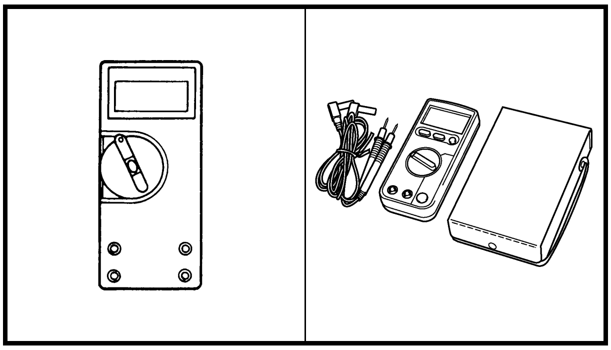



| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Bolt | 2 | |
| 9 | Bracket | 1 | |
| 10 | Grommet | 2 | |
| 11 | Collar | 2 | |
| | | | Reverse the removal steps for installation. |

# ELECTRICAL ANALYSIS
## INSPECTION

**CAUTION:**

- **All measuring instruments should be handled with special care. Damaged or mishandled instruments will not measure properly.**
- **On an instrument powered by dry batteries, check the battery's voltage periodically and replace the batteries if necessary.**



**Digital tester**

**NOTE:**
Throughout this chapter the part numbers of the specified digital testers have been omitted. Refer to the following part numbers.

**Digital multimeter:**
**YU-34899-A**
**Digital circuit tester:**
**90890-03174**

**NOTE:**
"○——○" indicates a continuity of electricity; i.e., a closed circuit at the respective switch position.

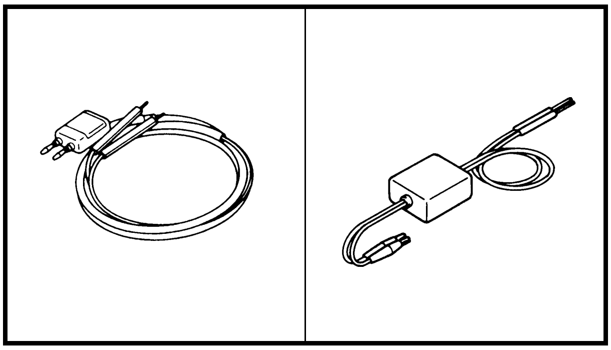
### Low resistance measurement

**NOTE:**
- When measuring a resistance of 10 Ω or less using a digital tester, the correct measurement cannot be obtained because of the tester's internal resistance.
- To obtain the correct value, subtract the internal resistance from the displayed measurement.
- The internal resistance of the tester can be obtained by connecting both of its terminals.

**Correct value =**
**Displayed measurement –**
**Internal resistance**

### Peak voltage measurement

**NOTE:**
- When checking the condition of the ignition system it is vital to know the peak voltage.
- Cranking speed is dependant on many factors (e.g., fouled or weak spark plugs, a weak battery). If one of these is defective, the peak voltage will be lower than specification.
- If the peak voltage measurement is not within specification the engine will not operate properly.
- A low peak voltage will also cause components to prematurely wear.

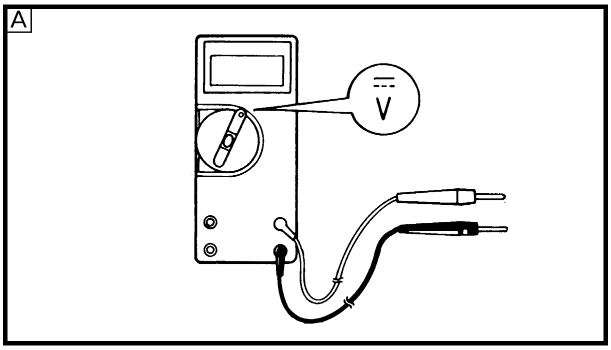


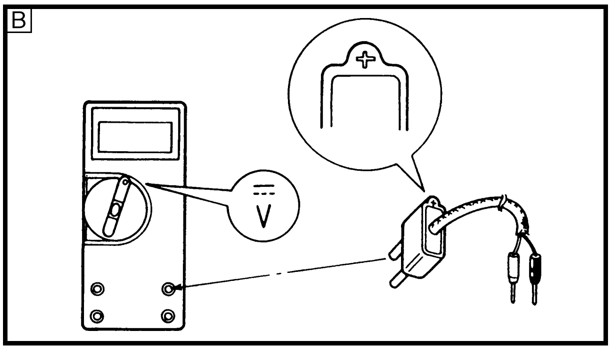
### Peak voltage adapter

**NOTE:**
- Throughout this chapter the part numbers of the specified peak voltage adapters have been omitted. Refer to the following part numbers.
- The peak voltage adapter should be used with a digital tester.

**Peak voltage adapter:**
**YU-39991**
**Peak voltage adapter B:**
**90890-03172**

- When measuring the peak voltage, connect the peak voltage adapter to the digital circuit tester and switch the selector to the DC voltage mode.

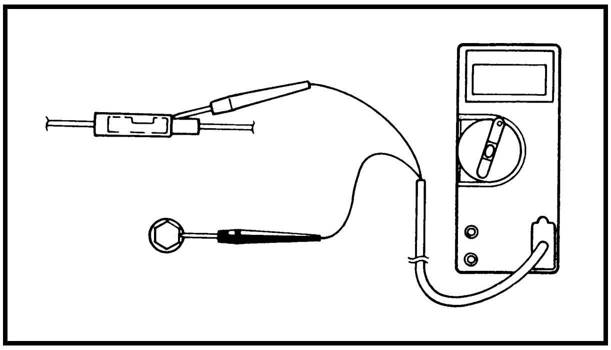


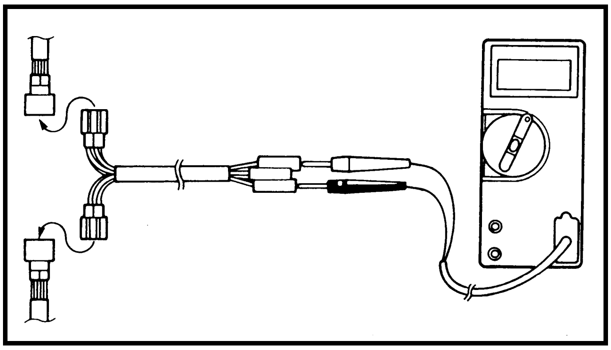


**NOTE:**
- Make sure that the adapter leads are properly installed in the digital circuit tester.
- Make sure that the positive pin (the "+" mark facing up as shown) on the adapter is installed into the positive terminal of the tester.
- The test harness is needed for the following tests.

A Voltage measurement
B Peak voltage measurement

### Test harness



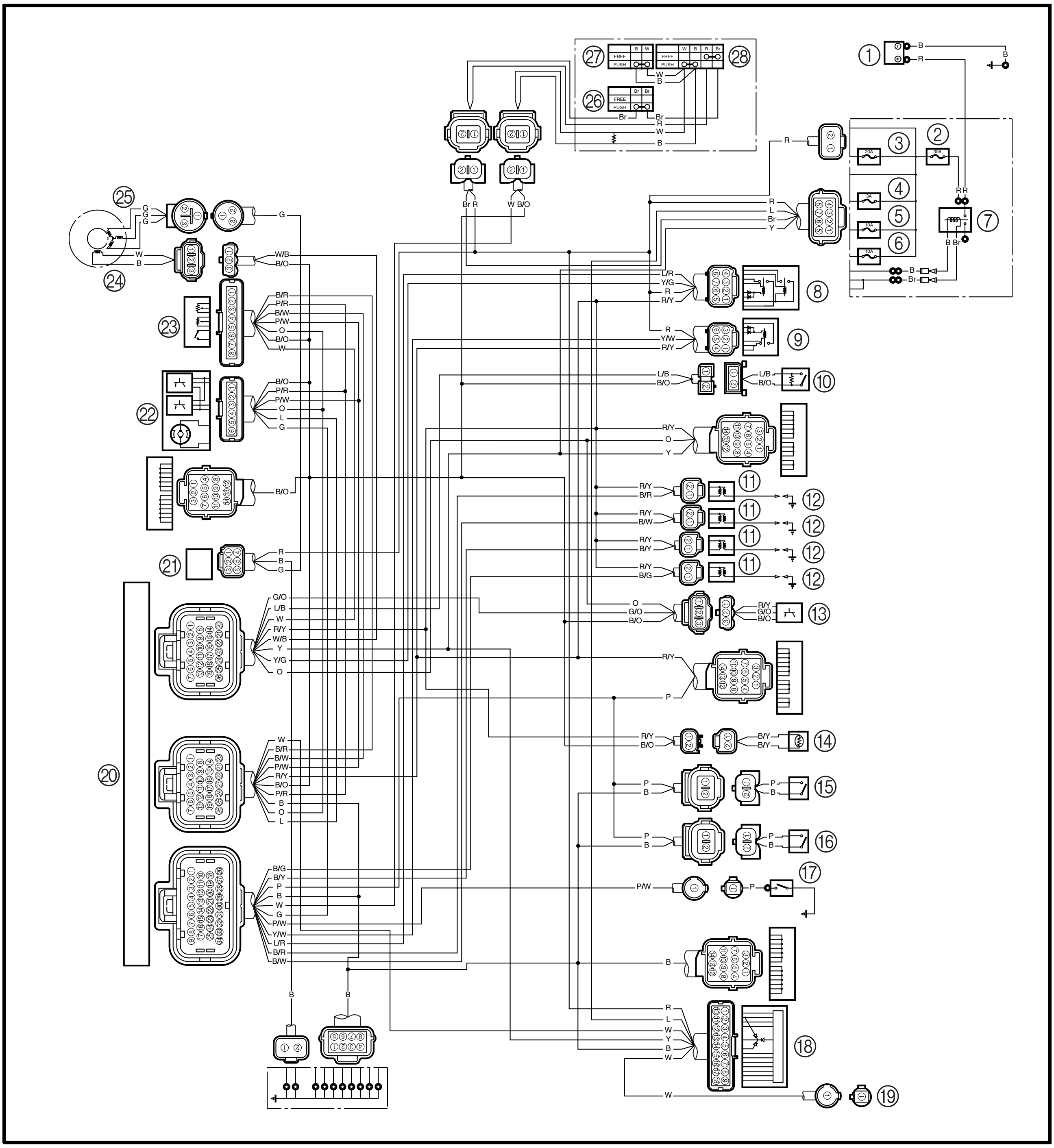


**Checking steps:**
- Disconnect the coupler connections.
- Connect the test harness between the couplers.
- Connect the tester terminals to the terminals which are being checked.
- Run the engine and observe the measurement.

**NOTE:**
If the lighting coil and pickup coil(s) are measured unloaded, disconnect the test harness on the output side coupler.

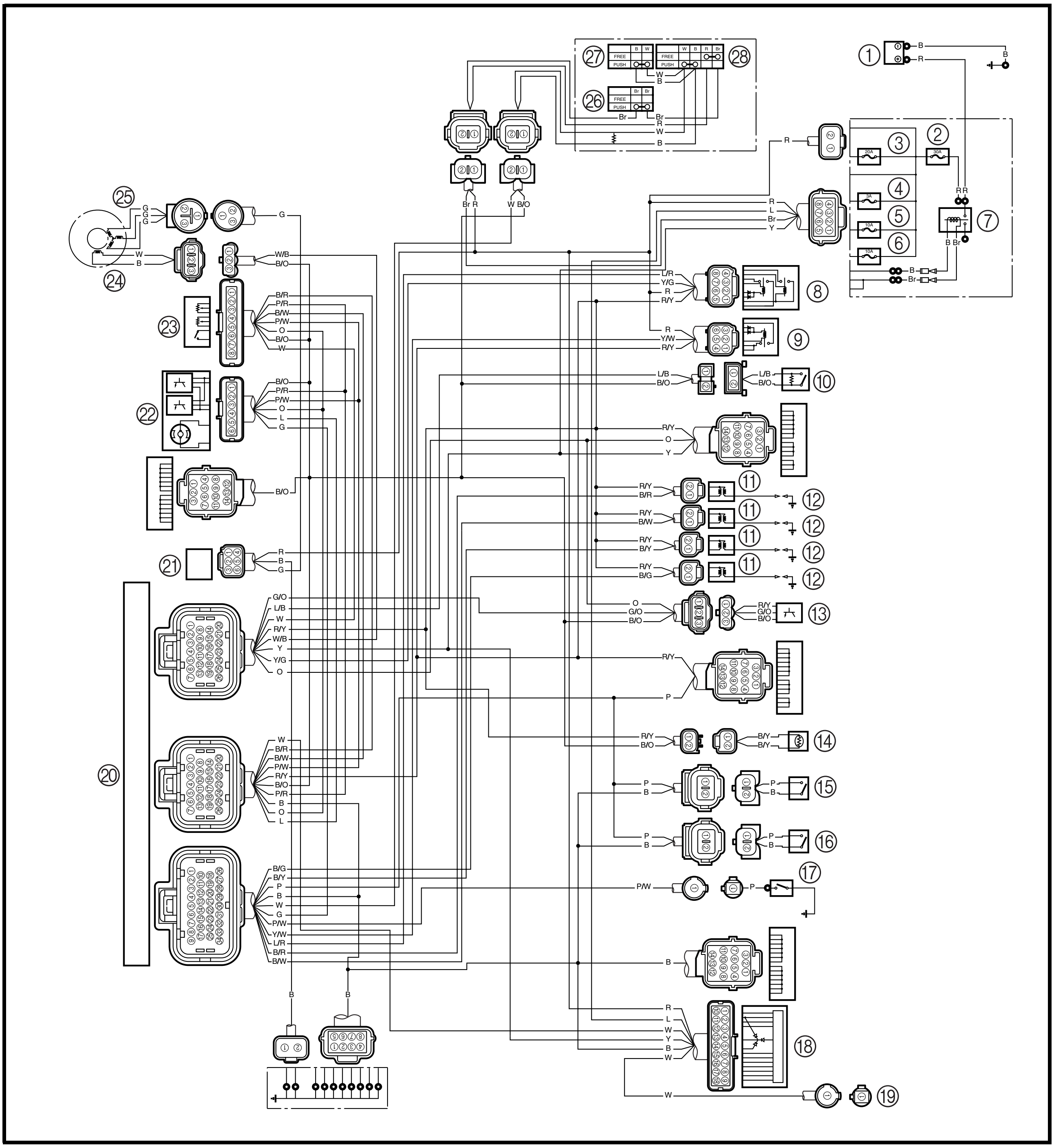
# IGNITION SYSTEM

## WIRING DIAGRAM

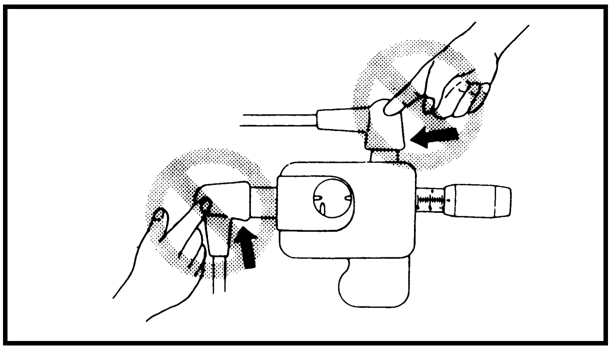


① Battery
② Fuse (30 A)
③ Fuse (20 A)
④ Fuse (3 A)
⑤ Fuse (10 A)
⑥ Fuse (10 A)
⑦ Starter relay
⑧ Main and fuel pump relay
⑨ Electronic control throttle valve relay
⑩ Slant detection switch
⑪ Ignition coil
⑫ Spark plug
⑬ Cam position sensor
⑭ Engine temperature sensor
⑮ Thermoswitch (engine)
⑯ Thermoswitch (exhaust)
⑰ Oil pressure switch
⑱ Remote control unit (Deluxe model only)
⑲ Antenna (Deluxe model only)
⑳ ECM
㉑ Rectifier/regulator
㉒ Throttle body assembly
㉓ Accelerator position sensor
㉔ Pickup coil
㉕ Lighting coil
㉖ Start switch
㉗ Engine stop switch
㉘ Engine shut-off switch

## WIRING DIAGRAM



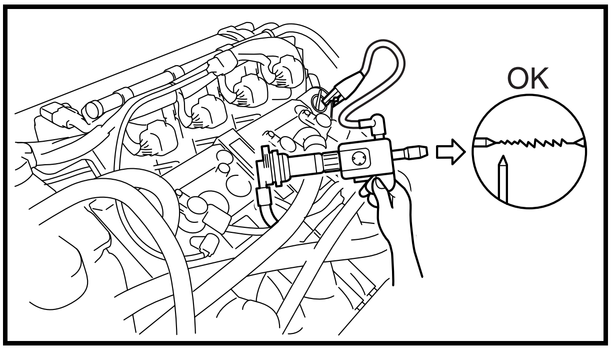
| | | | | | |
|---|---|---|---|---|---|
| B | : Black | B/G | : Black/green | P/W | : Pink/white |
| Br | : Brown | B/O | : Black/orange | R/Y | : Red/yellow |
| G | : Green | B/R | : Black/red | W/B | : White/black |
| L | : Blue | B/W | : Black/white | Y/G | : Yellow/green |
| O | : Orange | B/Y | : Black/yellow | Y/W | : Yellow/white |
| P | : Pink | G/O | : Green/orange | | |
| R | : Red | L/B | : Blue/black | | |
| W | : White | L/R | : Blue/red | | |
| Y | : Yellow | P/R | : Pink/red | | |



## IGNITION SPARK

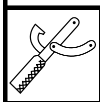
**⚠ WARNING**

- **When checking the spark gap, do not touch any of the connections of the spark checker/ignition tester lead wires.**
- **When performing the spark gap test, take special care not to let sparks leak out of the removed spark plug cap.**
- **When performing the spark gap check, keep flammable gas or liquids away, since this test can produce sparks.**




1. Check:
   - Ignition spark
     Weak → Check the ECM output peak voltage.
     Check the ignition coil for resistance.

**Checking steps:**
- Connect the spark plug cap to the special service tool.



**Spark checker:**
**YM-34487**
**Ignition tester:**
**90890-06754**

- Crank the engine and observe the ignition system spark through the discharge window.

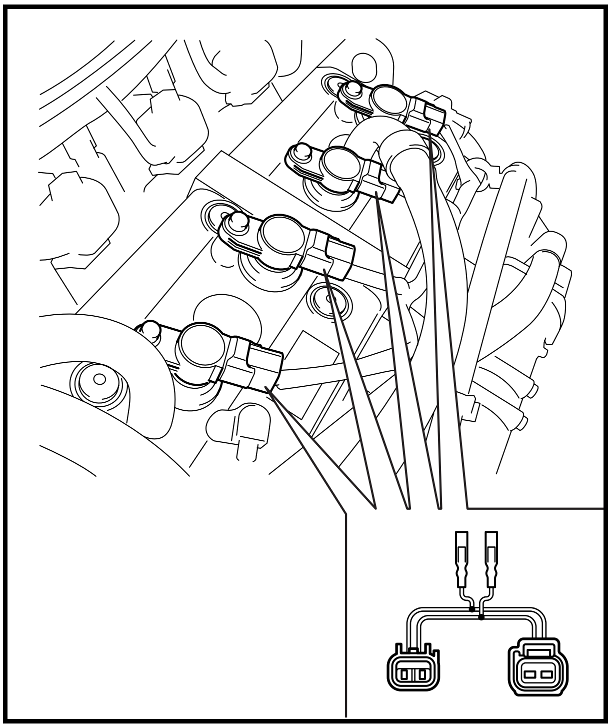
## IGNITION SYSTEM PEAK VOLTAGE

**WARNING**

**When checking the electrical components, do not touch any of the connections of the digital tester lead wires.**

**NOTE:**
- If there is no spark, or the spark is weak, continue with the ignition system test.
- If a good spark is obtained, the problem is not with the ignition system, but possibly with the spark plug(s) or another component.

1. Measure:
   - ECM output peak voltage
     Below specification → Measure the pickup coil output peak voltage.

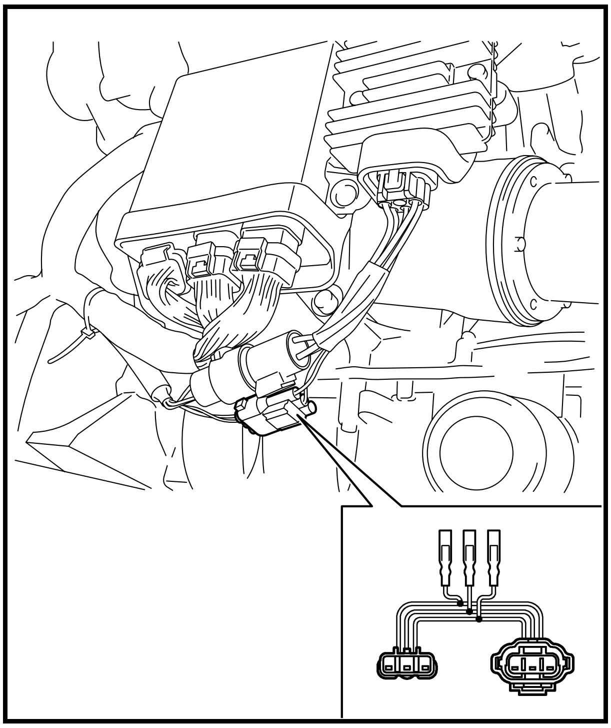


**Test harness (2 pins):**
**New: YB-06867**
**Current: YB-06767**
**Test harness FWY-2 (2 pins):**
**New: 90890-06867**
**Current: 90890-06767**

**ECM output peak voltage:**
**Black/red (B/R) – Red/yellow (R/Y)**
**Black/white (B/W) – Red/yellow (R/Y)**
**Black/yellow (B/Y) – Red/yellow (R/Y)**
**Black/green (B/G) – Red/yellow (R/Y)**

| r/min | Loaded | | |
|---|---|---|---|
| | Cranking | 2,000 | 3,500 |
| V | 90 | 130 | 140 |

**NOTE:**
- When measuring the ECM output peak voltage while cranking the engine, disconnect the ignition coil couplers for all cylinders except for the cylinder being measured.
- To crank the engine, connect the engine shut-off cord (lanyard) to the engine shut-off switch, and then press the start switch.



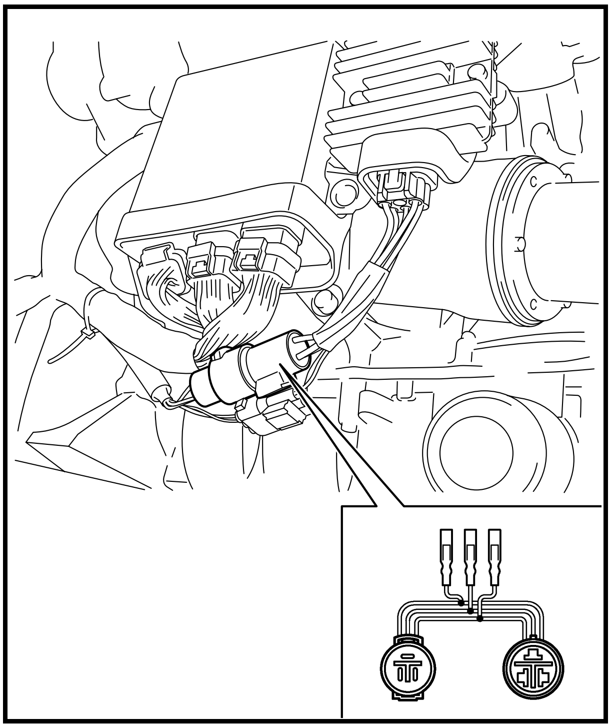
2. Measure:
   - Pickup coil output peak voltage
     Below specification → Replace the pickup coil.
     Above specification → Replace the ECM.

**Test harness (3 pins):**
**New: YB-06877**
**Current: YB-06777**
**Test harness HM090-3 (3 pins):**
**New: 90890-06877**
**Current: 90890-06777**

**Pickup coil output peak voltage:**
**White/black (W/B) – Black/orange (B/O)**

| r/min | Unloaded | Loaded | | |
|---|---|---|---|---|
| | Cranking | | 2,000 | 3,500 |
| V | 8.0 | 6.9 | 19.4 | 25.1 |

**NOTE:**
To crank the engine, connect the engine shut-off cord (lanyard) to the engine shut-off switch, and then press the start switch and engine stop switch simultaneously.



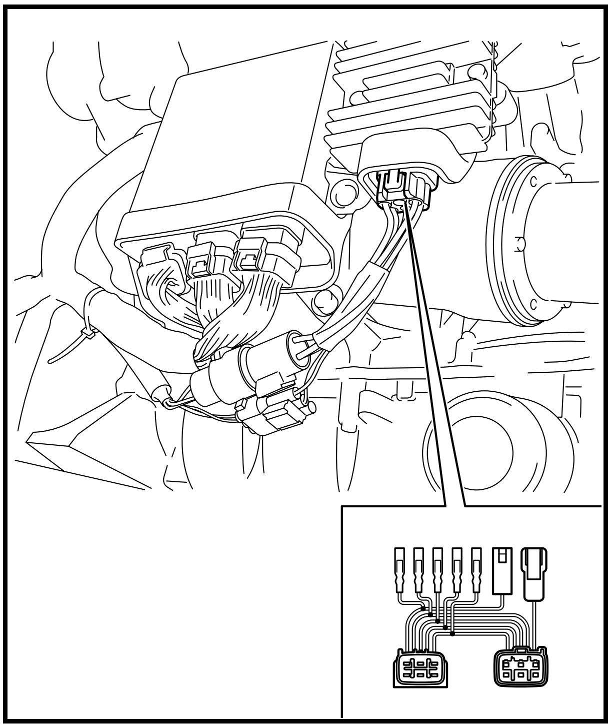
3. Measure:
   - Lighting coil output peak voltage
     Below specification → Replace the lighting coil.

**Test harness (3 pins):**
**New: YB-06870**
**Current: YB-06770**
**Test harness SMT250-3 (3 pins):**
**New: 90890-06870**
**Current: 90890-06770**

**Lighting coil output peak voltage:**
**Green (G) – Green (G)**

| r/min | Unloaded | | |
|---|---|---|---|
| | Cranking | 2,000 | 3,500 |
| V | 7.8 | 24.5 | 41.6 |

**NOTE:**
To crank the engine, connect the engine shut-off cord (lanyard) to the engine shut-off switch, and then press the start switch and engine stop switch simultaneously.



4. Measure:
   - Rectifier/regulator output voltage
     Below specification → Replace the rectifier/regulator.

**Test harness (6 pins):**
**YB-06848**
**Test harness FSW-6A (6 pins):**
**90890-06848**

**Rectifier/regulator output voltage:**
**Red (R) – Black (B)**

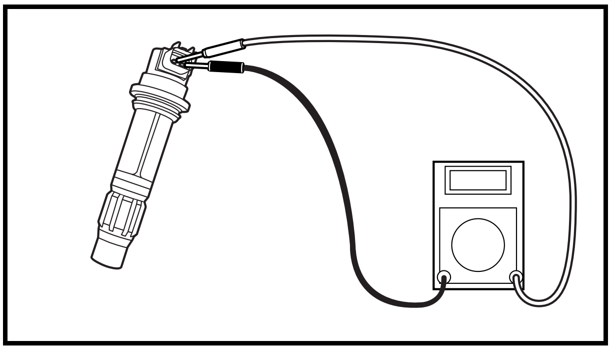
| r/min | Unloaded |
|---|---|
| | 3,500 |
| V | 13.0 |

**NOTE:**
- Do not use the peak voltage adapter to measure the output voltage.
- Disconnect the output lead of the tester harness.

## BATTERY
Refer to “ELECTRICAL” in Chapter 3.

## FUSE
Refer to “STARTING SYSTEM”.

## SPARK PLUGS
Refer to “POWER UNIT” in Chapter 3.

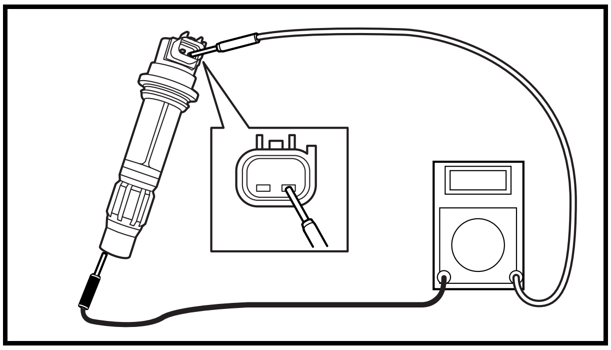


## IGNITION COIL

1. Measure:
   - Primary coil resistance
     Out of specification → Replace.

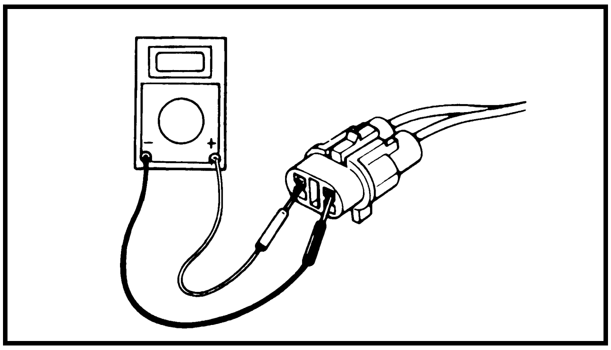
| Primary coil resistance: |
|---|
| 1.19–1.61 Ω at 20 °C (68 °F) |

**NOTE:**
When measuring a resistance of 10 Ω or less using a digital tester, the correct measurement cannot be obtained because of the tester's internal resistance.
Refer to "Low resistance measurement".



2. Measure:
   - Secondary coil resistance
     Out of specification → Replace.

| Secondary coil resistance: |
|---|
| 8.5–11.5 kΩ at 20 °C (68 °F) |

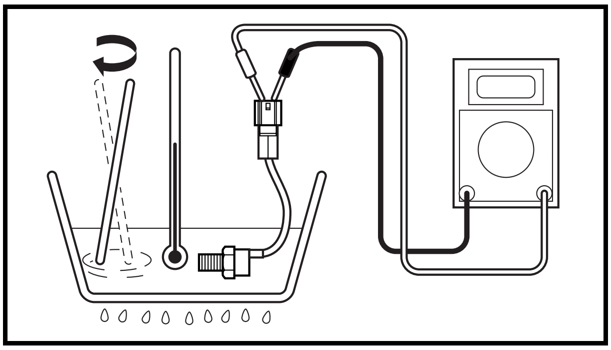


## ENGINE STOP SWITCH

1. Check:
   - Engine stop switch continuity
     Out of specification → Replace.

**Engine stop switch continuity (black coupler)**

| Clip | Position | Lead color | |
|---|---|---|---|
| | | White | Black |
| Installed | Free | | |
| | Push | ○— | —○ |
| Removed | Free | ○— | —○ |
| | Push | ○— | —○ |

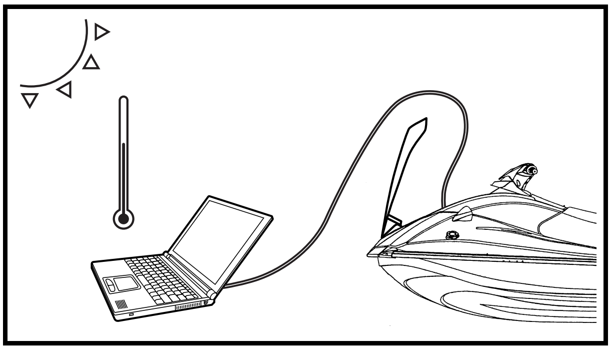


## ENGINE TEMPERATURE SENSOR

1. Measure:
   - Engine temperature sensor resistance (at the specified temperature)
     Out of specification → Replace.

**Engine temperature sensor resistance:**
**20 °C (68 °F): 54.2–69.0 kΩ**
**100 °C (212 °F): 3.12–3.48 kΩ**

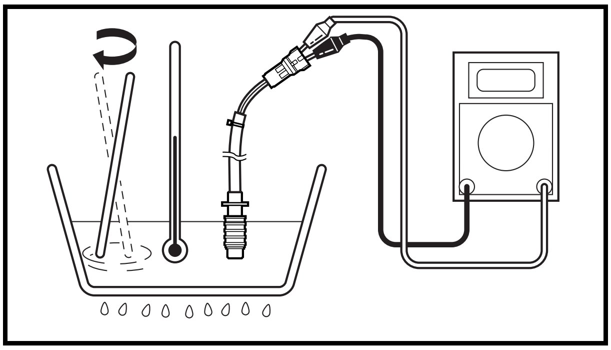
**Measurement steps:**
- Suspend the engine temperature sensor in a container filled with water.
- Place a thermometer in the water.
- Slowly heat the water.
- Measure the resistance when the specified temperature is reached.

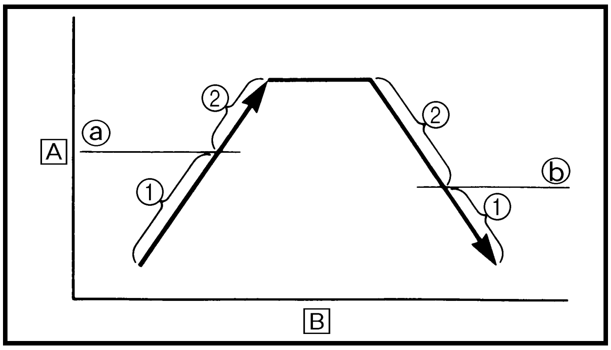


## SENSOR ASSEMBLY

1. Check:
   - Intake air temperature sensor
     Out of specification → Replace the sensor assembly.

**Checking steps:**
- Measure the ambient temperature.
- Connect a computer to the watercraft and use the Yamaha Diagnostic System to display the intake air temperature.
- If the ambient temperature and the displayed intake air temperature differ by more than ± 5 °C (± 9 °F), replace the sensor assembly.






## THERMOSWITCH (ENGINE)

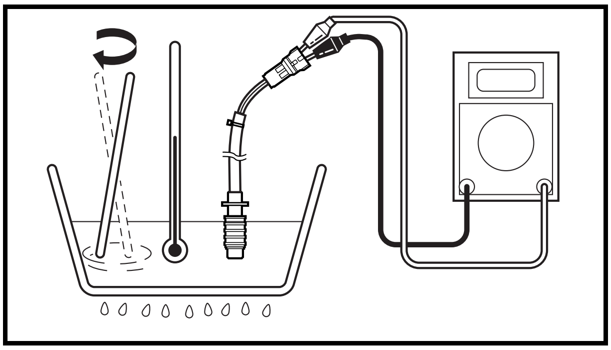
1. Check:
   - Thermoswitch (engine) continuity (at the specified temperature)
     Out of specification → Replace.

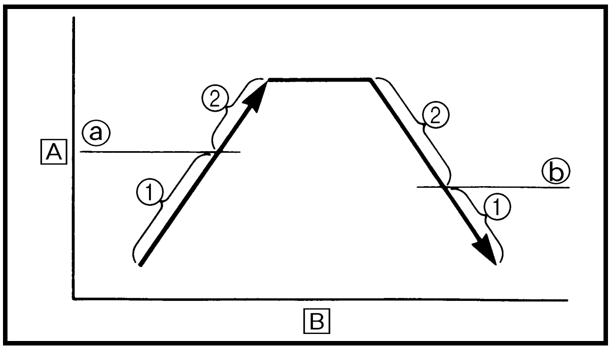
**Thermoswitch (engine) continuity temperature:**
**ⓐ 84–90 °C (183–194 °F)**
**ⓑ 70–84 °C (158–183 °F)**

① No continuity
② Continuity
A Temperature
B Time

**Checking steps:**
- Suspend the thermoswitch (engine) in a container filled with water.
- Place a thermometer in the water.
- Slowly heat the water.
- Measure the continuity when the specified temperature is reached.

**NOTE:**
The thermoswitch (engine) connector is blue.






## THERMOSWITCH (EXHAUST)

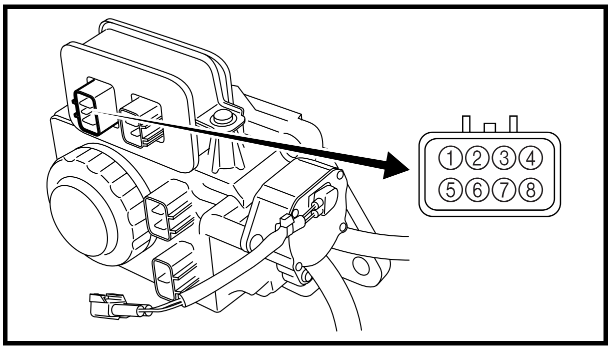
1. Check:
   - Thermoswitch (exhaust) continuity (at the specified temperature)
     Out of specification → Replace.

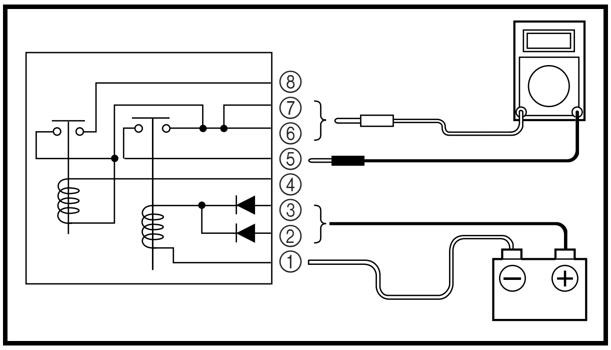
**Thermoswitch (exhaust) continuity temperature:**
**ⓐ 80–86 °C (176–187 °F)**
**ⓑ 66–80 °C (151–176 °F)**

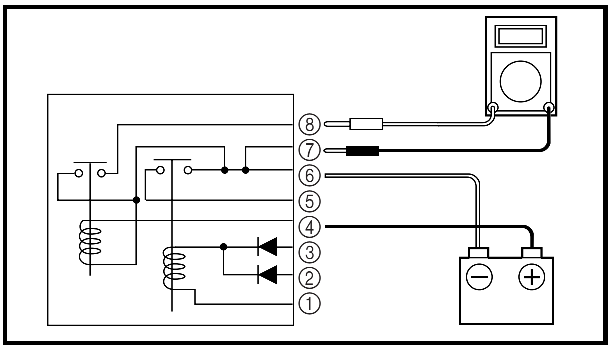
① No continuity
② Continuity
[A] Temperature
[B] Time

**Checking steps:**
- Suspend the thermoswitch (exhaust) in a container filled with water.
- Place a thermometer in the water.
- Slowly heat the water.
- Measure the continuity when the specified temperature is reached.

**NOTE:**
The thermoswitch (exhaust) connector is black.



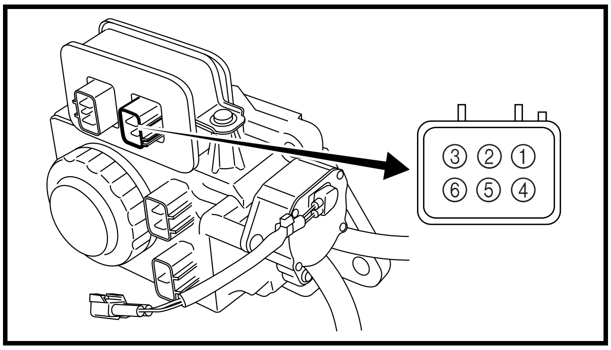



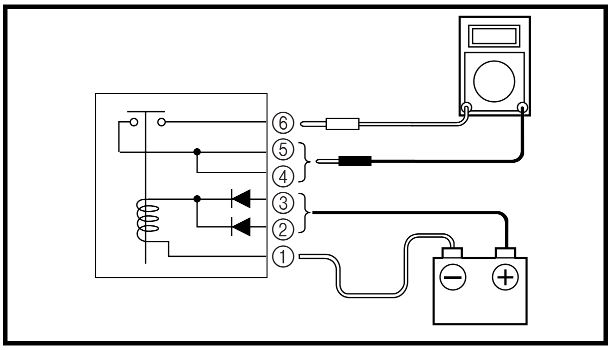




## MAIN AND FUEL PUMP RELAY

1. Check:
   - Main and fuel pump relay continuity
     Faulty → Replace.

**Checking steps:**
- Connect the tester leads to the main and fuel pump relay terminals ⑤ and ⑥ or ⑦.
- Connect terminals ② or ③ to the positive battery terminal.
- Connect terminal ① to the negative battery terminal.
- Check that there is continuity between the main and fuel pump relay terminals.
- Check that there is no continuity between the main and fuel pump relay terminals after disconnecting terminals ①, ②, or ③.
- Connect the tester leads between main and fuel pump relay terminals ⑦ and ⑧.
- Connect terminals ④ to the positive battery terminal.
- Connect terminal ⑥ to the negative battery terminal.
- Check that there is continuity between the main and fuel pump relay terminals.
- Check that there is no continuity between the main and fuel pump relay terminals after disconnecting terminals ④ or ⑥.

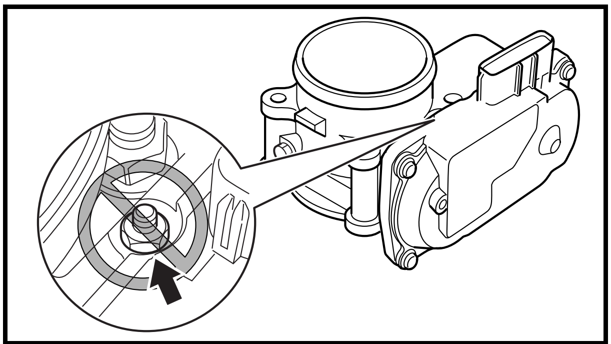


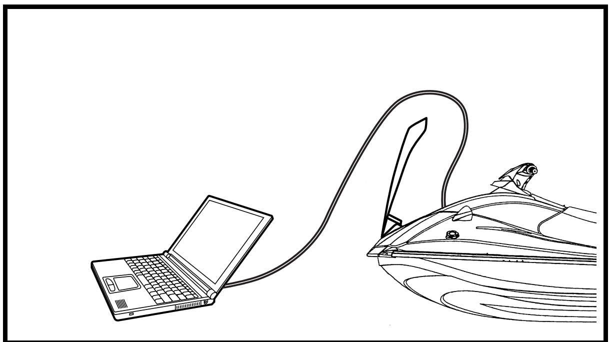



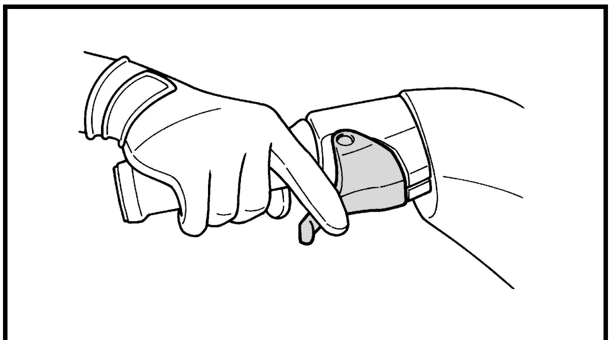

## ELECTRONIC CONTROL THROTTLE VALVE RELAY

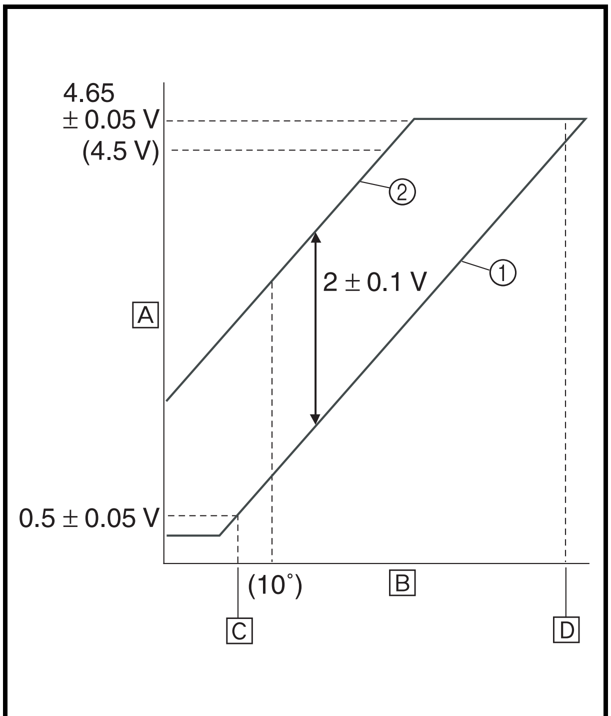
1. Check:
   - Electronic control throttle valve relay continuity
     Faulty → Replace.

**Checking steps:**
- Connect the tester leads to the electronic control throttle valve relay terminals ④ or ⑤ and ⑥.
- Connect terminals ② or ③ to the positive battery terminal.
- Connect terminal ① to the negative battery terminal.
- Check that there is continuity between the electronic control throttle valve relay terminals.
- Check that there is no continuity between the electronic control throttle valve relay terminals after disconnecting terminals ①, ②, or ③.










## THROTTLE POSITION SENSOR

1. Measure:
   - Throttle position sensor output voltage
     Out of specification → Replace the throttle body assembly.

**Checking steps:**

**CAUTION:**

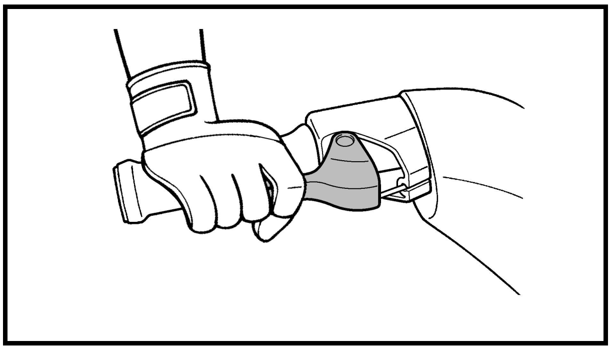
**Do not loosen the throttle stop screw nut and do not turn the throttle stop screw.**

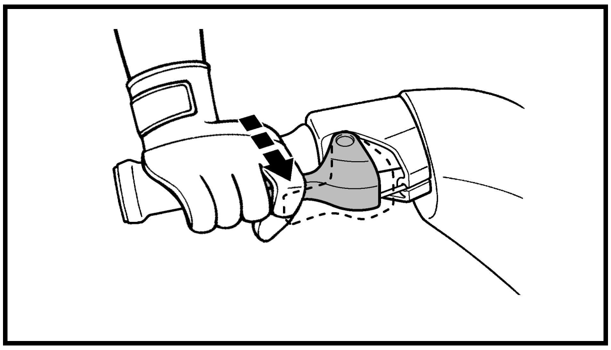
- Connect a computer to the watercraft and use the Yamaha Diagnostic System to display the “throttle position sensor 1 output voltage”, “throttle valve opening angle”, and “throttle position sensor 2 output voltage”.
- Release the throttle lever to the fully closed position.
- Check the output voltage of throttle position sensor 1 and the throttle valve opening angle.

① Throttle position sensor 1
② Throttle position sensor 2
A Throttle position sensor output voltage
B Throttle valve opening angle
C Fully closed
D Fully open

**NOTE:**
The actual throttle position sensor output voltage and throttle valve opening angle may vary according to environmental conditions.

**Throttle position sensor 1 output voltage with throttle lever fully closed:**
**0.45–0.95 V (reference data)**
**Throttle valve opening angle with throttle lever fully closed:**
**–1.1–9.4° (reference data)**





- Squeeze the throttle lever to the fully open position and hold it.
- Check the output voltage of throttle position sensor 2 and the throttle valve opening angle.

**Throttle position sensor 2 output voltage with throttle lever fully open:**
**4.60–4.70 V**
**Throttle valve opening angle with throttle lever fully open:**
**above 80° (reference data)**

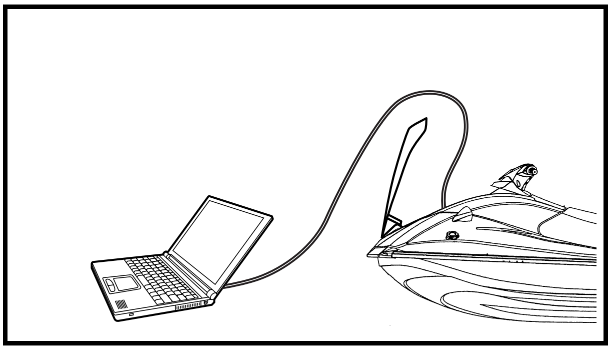
- Release the throttle lever from the fully open position to the fully closed position slowly and check the output voltage of throttle position sensor 2 and the throttle valve opening angle.
- Hold the throttle lever when the output voltage of throttle position sensor 2 is below 4.5 V and the throttle valve opening angle is above 10°.
- Calculate the difference of the output voltage of throttle position sensor 1 and the output voltage of throttle position sensor 2.

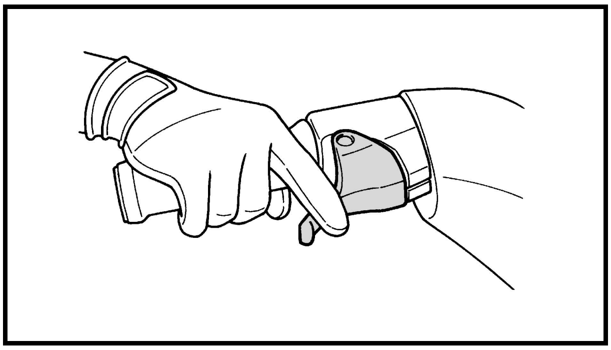
**Throttle position sensor 2 output voltage – throttle position sensor 1 output voltage = 1.9–2.1 V**

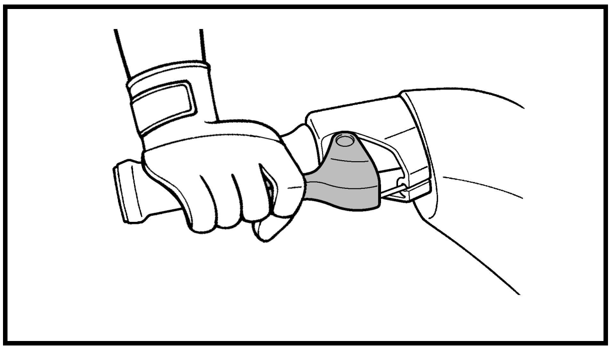
Example:
If the output voltage of throttle position sensor 1 is 2.5 V and the output voltage of throttle position sensor 2 is 4.5 V, then
4.5 – 2.5 = 2.0 V

- Operate the throttle lever and check that the output voltage of throttle position sensors 1 and 2 changes continuously.

**NOTE:**
The maximum output voltage of throttle position sensor 2 is 4.65 ± 0.05 V at the half open position.







## ACCELERATOR POSITION SENSOR

1. Measure:
   - Accelerator position sensor output voltage
     Out of specification → Replace the accelerator position sensor.

**Checking steps:**

- Connect a computer to the watercraft and use the Yamaha Diagnostic System to display the "accelerator position sensor 1" and "accelerator position sensor 2".
- Release the throttle lever to the fully closed position.
- Check that the accelerator position sensor 1 and 2 output voltage.

**NOTE:**
The actual accelerator position sensor output voltage and throttle valve opening angle may vary according to environmental conditions.

**Accelerator position sensor 1 output voltage at throttle lever fully closed position:**
**0.50–0.90 V**
**Accelerator position sensor 2 output voltage at throttle lever fully closed position:**
**0.35–1.05 V**
**Throttle valve opening angle at throttle lever fully closed position:**
**2.7–4.8°**

- Squeeze the throttle lever to the fully open position and hold it.
- Check that the accelerator position sensor 1 and 2 output voltage.

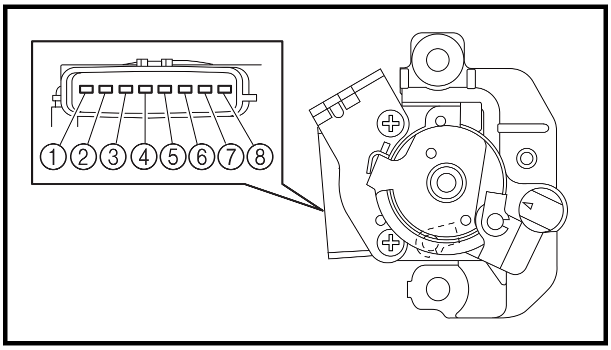
**Accelerator position sensor 1 output voltage at throttle lever fully opened position:**
**3.75–4.35 V**
**Accelerator position sensor 2 output voltage at throttle lever fully opened position:**
**3.50–4.50 V**
**Throttle valve opening angle at throttle lever fully opened position:**
**above 61°**

- Calculate the difference of the accelerator position sensor 1 output voltage and accelerator position sensor 2 output voltage at fully opened position.

**Accelerator position sensor 1 output voltage – Accelerator position sensor 2 output voltage at fully opened position = below 0.75 V**

Example:
If accelerator position sensor 1 output voltage is 4.009 V and accelerator position sensor 2 output voltage is 3.896 V, then 4.009 – 3.896 = 0.113 V

- Operate the throttle lever, and check that the accelerator position sensor 1 and 2 output voltage changes continuously.




2. Measure:
   - Accelerator position sensor resistance
     Out of specification → Replace the accelerator position sensor.

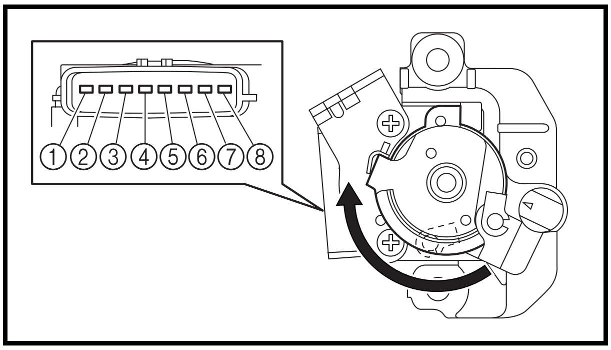
**Checking steps:**

- Connect the tester leads accelerator position sensor terminals ①, ③.
- Measure the resistance when the fully closed position.

**Accelerator position sensor 1 resistance at fully closed position:**
**0.50–0.90 kΩ**

- Connect the tester leads accelerator position sensor terminals ⑥, ⑦.
- Measure the resistance when the fully closed position.

**Accelerator position sensor 2 resistance at fully closed position:**
**0.35–1.05 kΩ**



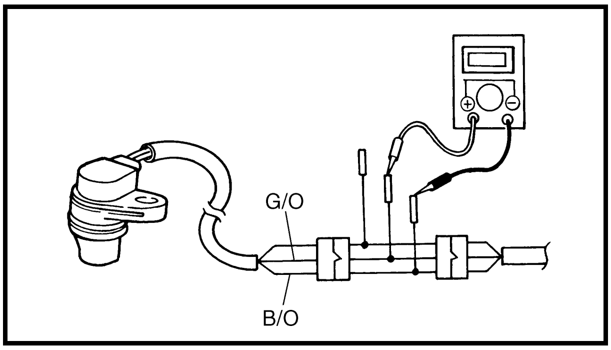

- Move the accelerator position cam to the fully opened position.
- Connect the tester leads accelerator position sensor terminals ①, ③.
- Measure the resistance when the fully opened position.

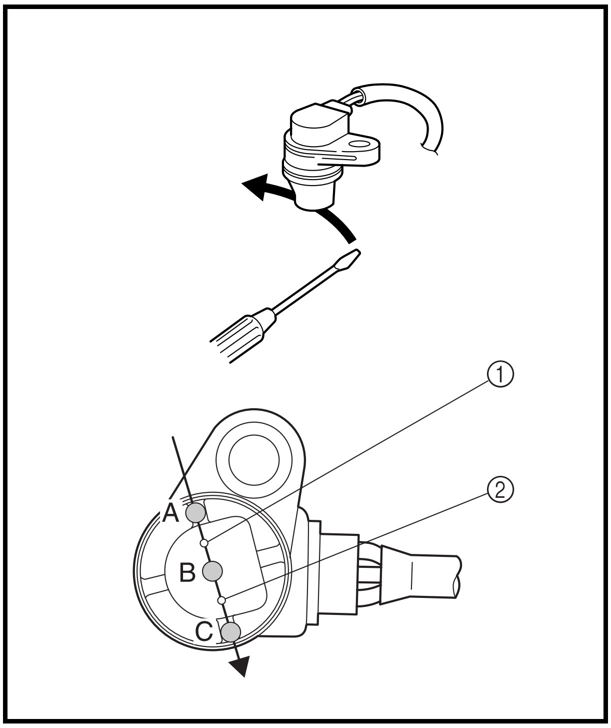
**Accelerator position sensor 1 resistance at fully opened position:**
**3.75–4.35 kΩ**

- Connect the tester leads accelerator position sensor terminals ⑥, ⑦.
- Measure the resistance when the fully opened position.

**Accelerator position sensor 2 resistance at fully opened position:**
**3.60–4.50 kΩ**

- Operate the accelerator cam, and check that the accelerator position sensor 1 and 2 resistance changes continuously.




## CAM POSITION SENSOR

1. Measure:
   - Cam position sensor output voltage
     Out of specification → Replace.

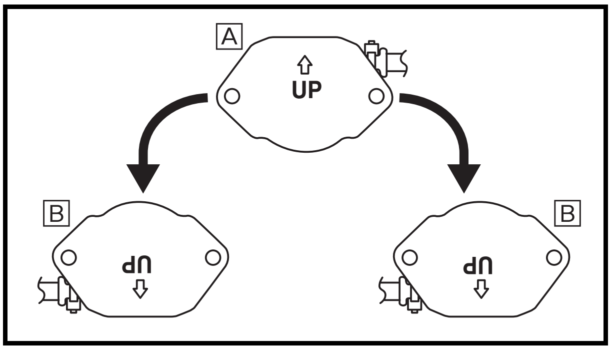
**Test harness (3 pins):**
**New: YB-06877**
**Current: YB-06777**
**Test harness HM090-3 (3 pins):**
**New: 90890-06877**
**Current: 90890-06777**

**Cam position sensor output voltage:**
**Green/orange (G/O) – Black/orange (B/O)**

| Position | Voltage (V) |
|---|---|
| A | More than 4.8 |
| B | Less than 0.8 |
| C | More than 4.8 |

**Measurement steps:**
- Remove the cam position sensor.
- Connect the test harness to the cam position sensor.
- Operate the Yamaha Diagnostic System.
- Pass a screwdriver under the cam position sensor in the direction shown and measure the output voltage.

**NOTE:**
- The cam position sensor consists of two individual sensors as shown in the illustration: sensor 1 ① and sensor 2 ②.
- To measure the output voltage, pass a screwdriver under the cam position sensor at measuring points A, B (center), and C in this order.
- When operating the Yamaha Diagnostic System, electric power is supplied to the cam position sensor.



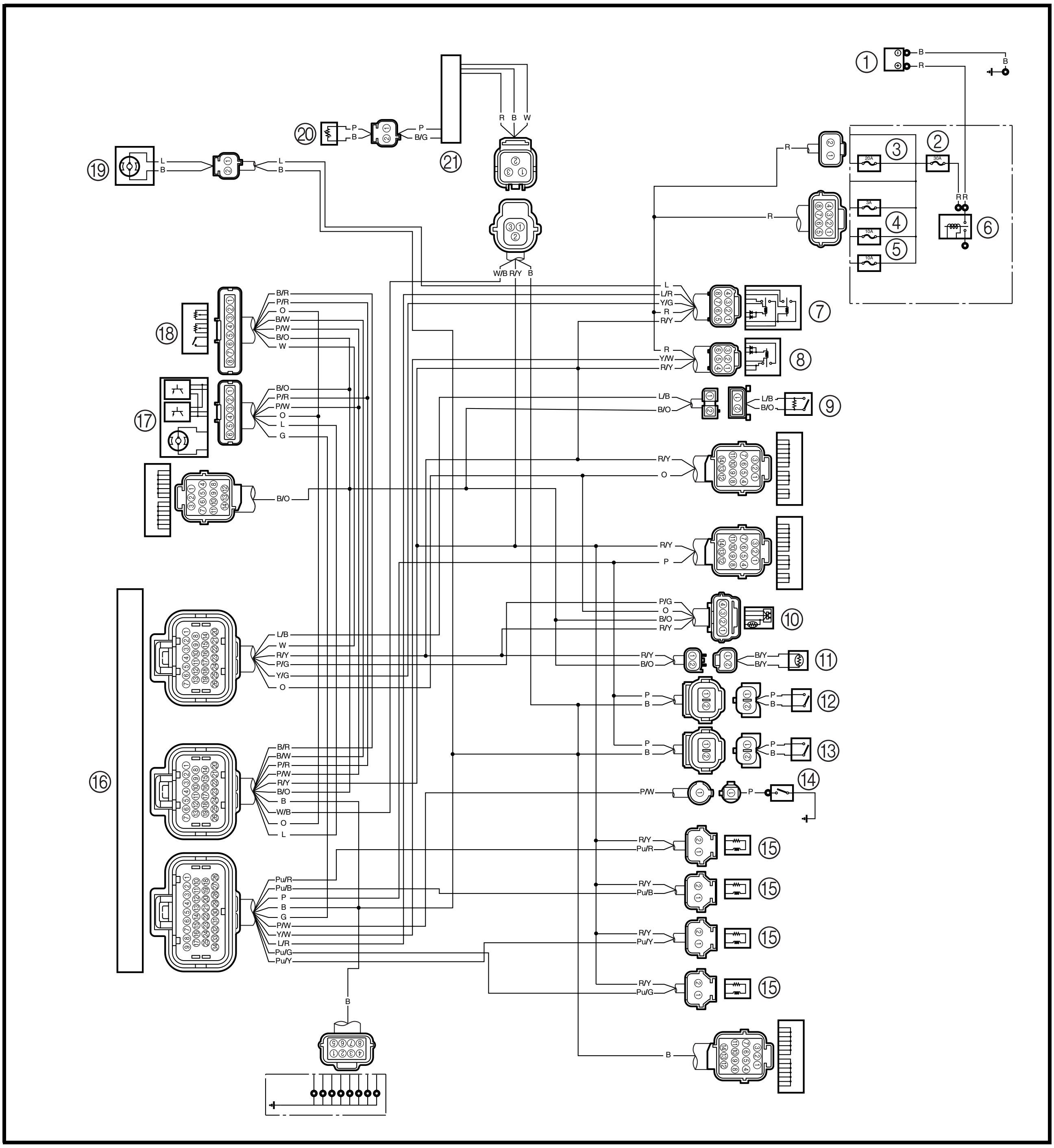

## SLANT DETECTION SWITCH

1. Check:
   - Slant detection switch operation
     Out of specification → Replace.

**NOTE:**
When checking the slant detection switch be sure to turn the switch over to both the left and right as shown in the illustration.

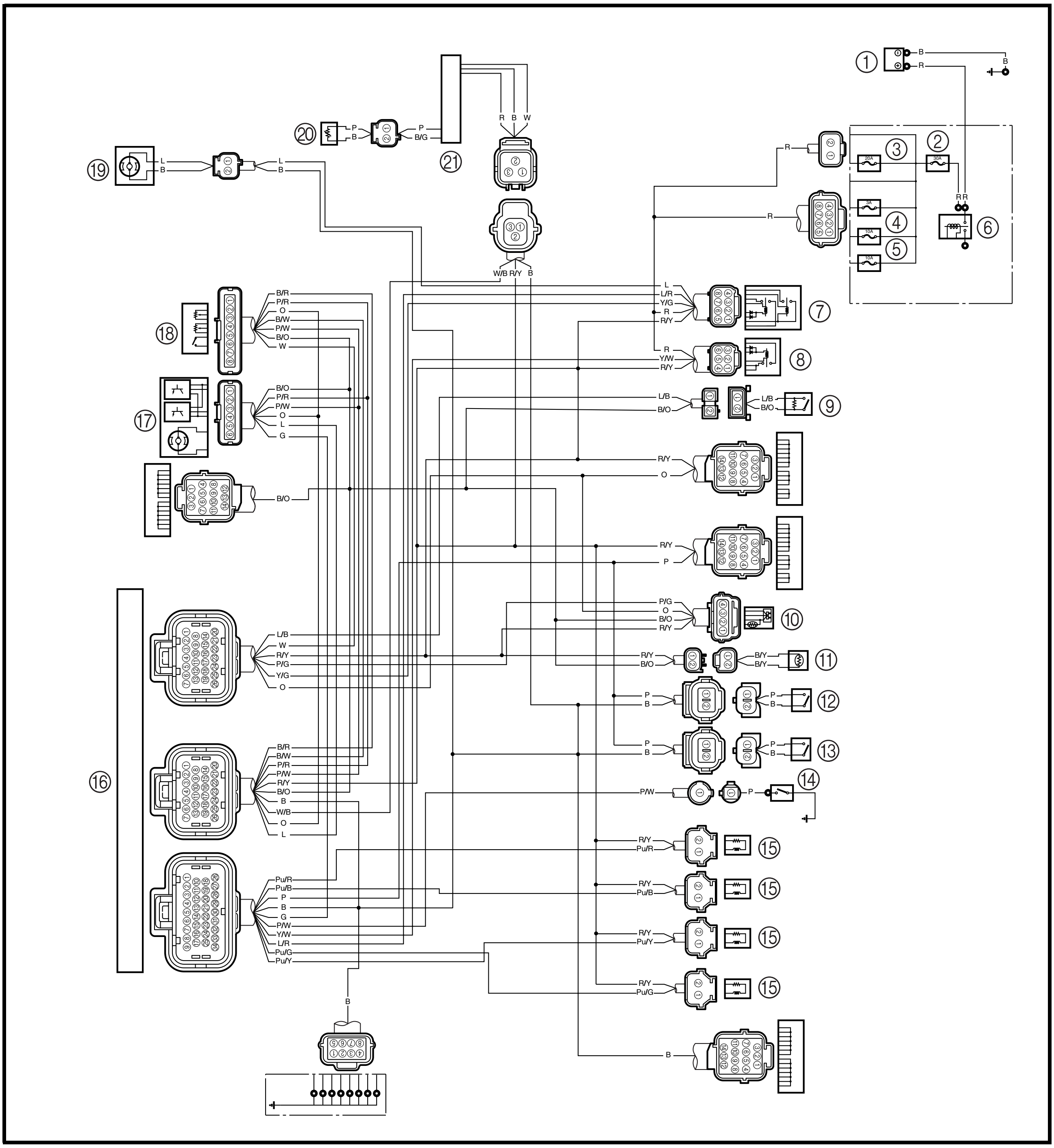
| Position | Lead color | |
|---|---|---|
| | **Blue/black (L/B)** | **Black/orange (B/O)** |
| **Normal operation** A | **4.18–5.10 kΩ** | |
| **Overturned** B | ○— | —○ |

# FUEL CONTROL SYSTEM
## WIRING DIAGRAM

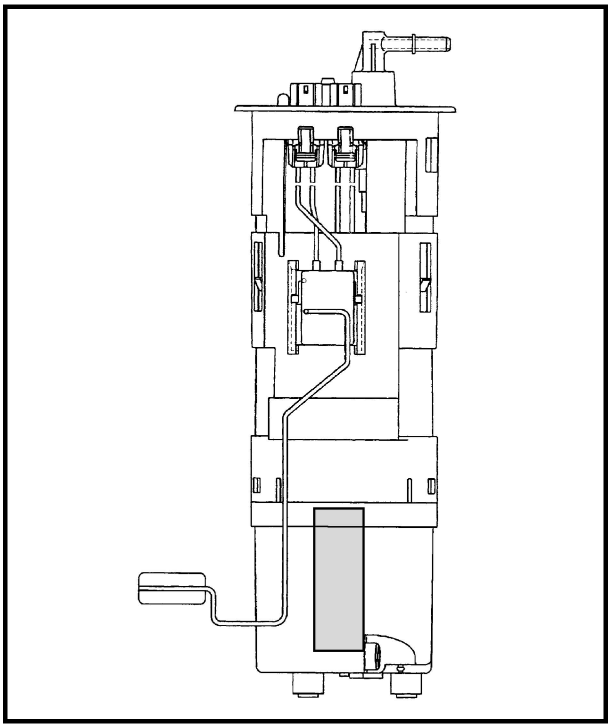


① Battery
② Fuse (30 A)
③ Fuse (20 A)
④ Fuse (10 A)
⑤ Fuse (10 A)
⑥ Starter relay
⑦ Main and fuel pump relay
⑧ Electronic control throttle valve relay
⑨ Slant detection switch
⑩ Sensor assembly (intake air pressure and intake air temperature)
⑪ Engine temperature sensor
⑫ Thermoswitch (engine)
⑬ Thermoswitch (exhaust)
⑭ Oil pressure switch
⑮ Fuel injector
⑯ ECM
⑰ Throttle body assembly
⑱ Accelerator position sensor
⑲ Electric fuel pump
⑳ Fuel sender
㉑ Multifunction meter

## WIRING DIAGRAM

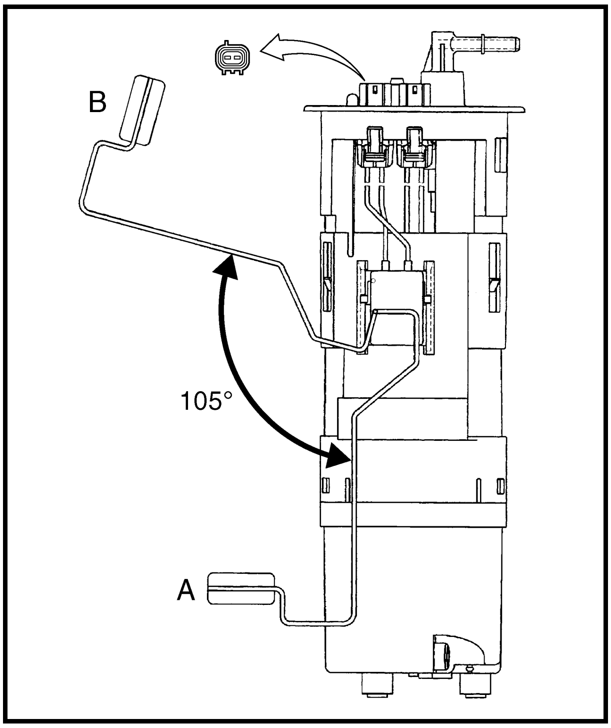



B : Black
G : Green
L : Blue
O : Orange
P : Pink
R : Red
W : White
B/G : Black/green
B/O : Black/orange
B/R : Black/red
B/W : Black/white
L/B : Blue/black
L/R : Blue/red
P/G : Pink/green
P/R : Pink/red
P/W : Pink/white
Pu/B : Purple/black
Pu/G : Purple/green
Pu/R : Purple/red
Pu/Y : Purple/yellow
R/Y : Red/yellow
W/B : White/black
Y/G : Yellow/green
Y/W : Yellow/white



## ELECTRIC FUEL PUMP

1. Check:
   - Fuel pump operating sound
     Fuel pump does not sound → Measure the fuel pressure.
     Refer to “FUEL INJECTION SYSTEM” in Chapter 4.




## FUEL SENDER

1. Measure:
   - Fuel sender resistance
     Out of specification → Replace.

| | Float position | Resistance (Ω) |
|---|---|---|
| | A | 133.5–136.5 |
| | B | 5–7 |

### FUEL INJECTOR
Refer to "FUEL INJECTION SYSTEM" in Chapter 4.

### MAIN AND FUEL PUMP RELAY
Refer to "IGNITION SYSTEM".

### OIL PRESSURE SWITCH
Refer to "INDICATION SYSTEM".

### THERMOSWITCH (ENGINE)
Refer to "IGNITION SYSTEM".

### THERMOSWITCH (EXHAUST)
Refer to "IGNITION SYSTEM".

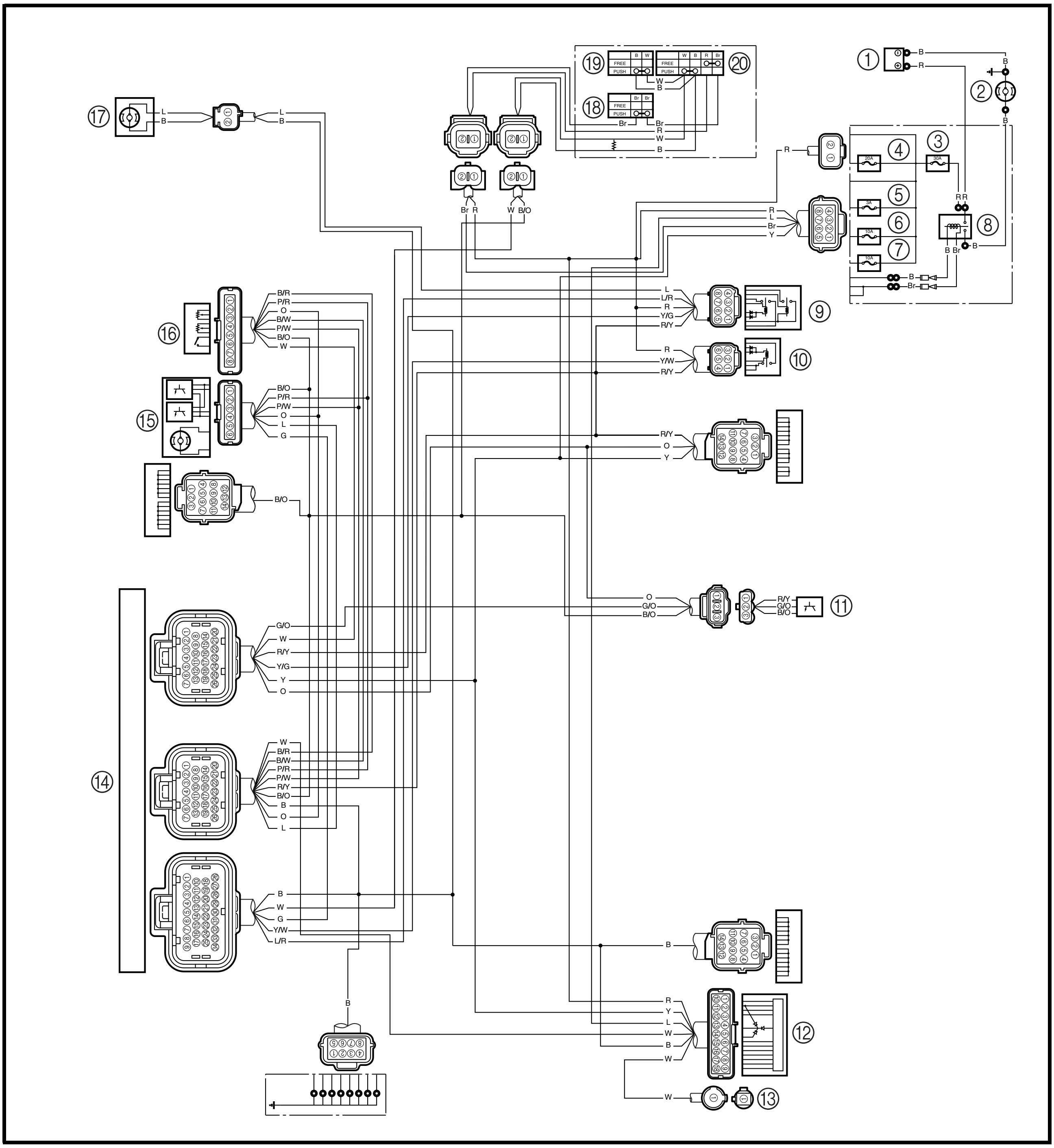
### SLANT DETECTION SWITCH
Refer to "IGNITION SYSTEM".

### REMOTE CONTROL UNIT (DELUXE MODEL ONLY)
Refer to "REMOTE CONTROL SYSTEM (DELUXE MODEL ONLY)".

### THROTTLE POSITION SENSOR
Refer to "IGNITION SYSTEM".

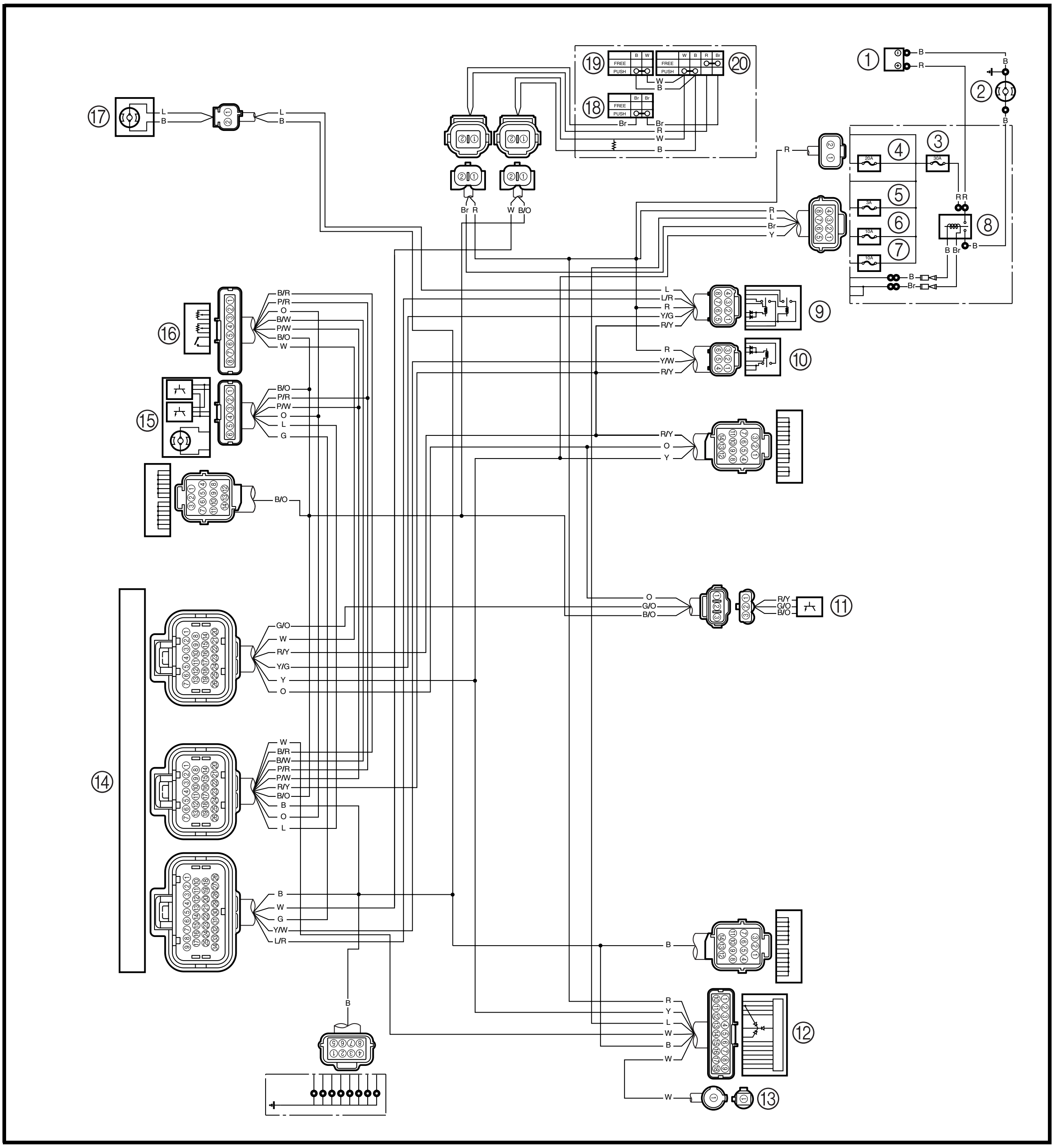
### ACCELERATOR POSITION SENSOR
Refer to "IGNITION SYSTEM".

# STARTING SYSTEM
## WIRING DIAGRAM




① Battery
② Starter motor
③ Fuse (30 A)
④ Fuse (20 A)
⑤ Fuse (3 A)
⑥ Fuse (10 A)
⑦ Fuse (10 A)
⑧ Starter relay
⑨ Main and fuel pump relay
⑩ Electronic control throttle valve relay
⑪ Cam position sensor
⑫ Remote control unit
⑬ Antenna
⑭ ECM
⑮ Throttle body assembly
⑯ Accelerator position sensor
⑰ Electric fuel pump
⑱ Start switch
⑲ Engine stop switch
⑳ Engine shut-off switch

## WIRING DIAGRAM



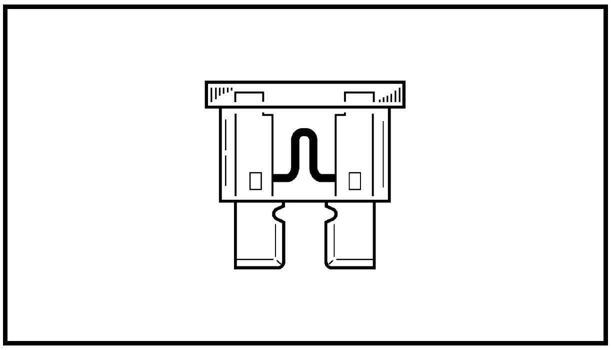
| | | | |
|---|---|---|---|
| B | : Black | B/R | : Black/red |
| Br | : Brown | B/W | : Black/white |
| G | : Green | G/O | : Green/orange |
| L | : Blue | L/R | : Blue/red |
| O | : Orange | P/R | : Pink/red |
| R | : Red | P/W | : Pink/white |
| W | : White | R/Y | : Red/yellow |
| Y | : Yellow | Y/G | : Yellow/green |
| B/O | : Black/orange | Y/W | : Yellow/white |

## BATTERY

Refer to "ELECTRICAL" in Chapter 3.

## WIRING CONNECTIONS

1. Check:
   - Wiring connections
     Poor connections → Properly connect.

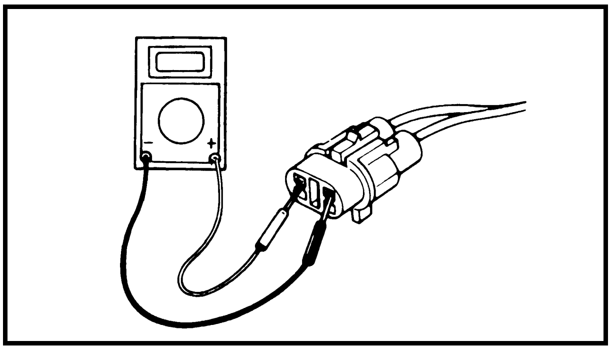


## FUSES

1. Check:
   - Fuses
     Broken → Replace.

**Fuse ratings:**
**3 A, 10 A, 20 A, 30 A**

**NOTE:**
The 3 A fuse is for the remote control unit (Deluxe model only).
The 10 A fuse is for the main and fuel pump relay and the electronic control throttle valve relay.
The 20 A fuse is for main and fuel pump relay.
The 30 A fuse is for the main relay.



## START SWITCH

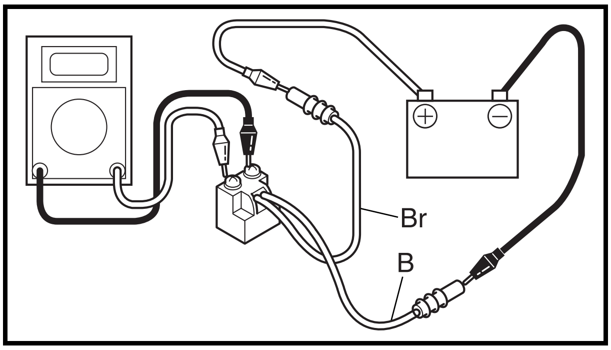
1. Check:
   - Continuity
     Out of specification → Replace.

**Start switch continuity (natural color coupler)**

| Clip | Position | Leads | |
|---|---|---|---|
| | | Red | Brown |
| Installed | Free | | |
| | Push | ○— | —○ |
| Removed | Free | | |
| | Push | | |

## STARTER RELAY

1. Inspect:
   - Brown lead terminal
   - Black lead terminal
     Loose → Tighten.




2. Check:
   - Starter relay
     Faulty → Replace.

**Checking steps:**
- Connect the tester leads between the starter relay terminals as shown.
- Connect the brown lead terminal to the positive battery terminal.
- Connect the black lead terminal to the negative battery terminal.
- Check that there is continuity between the starter relay terminals.
- Check that there is no continuity after the brown or black lead is removed.

## REMOTE CONTROL UNIT (DELUXE MODEL ONLY)

Refer to “REMOTE CONTROL SYSTEM (DELUXE MODEL ONLY)”.

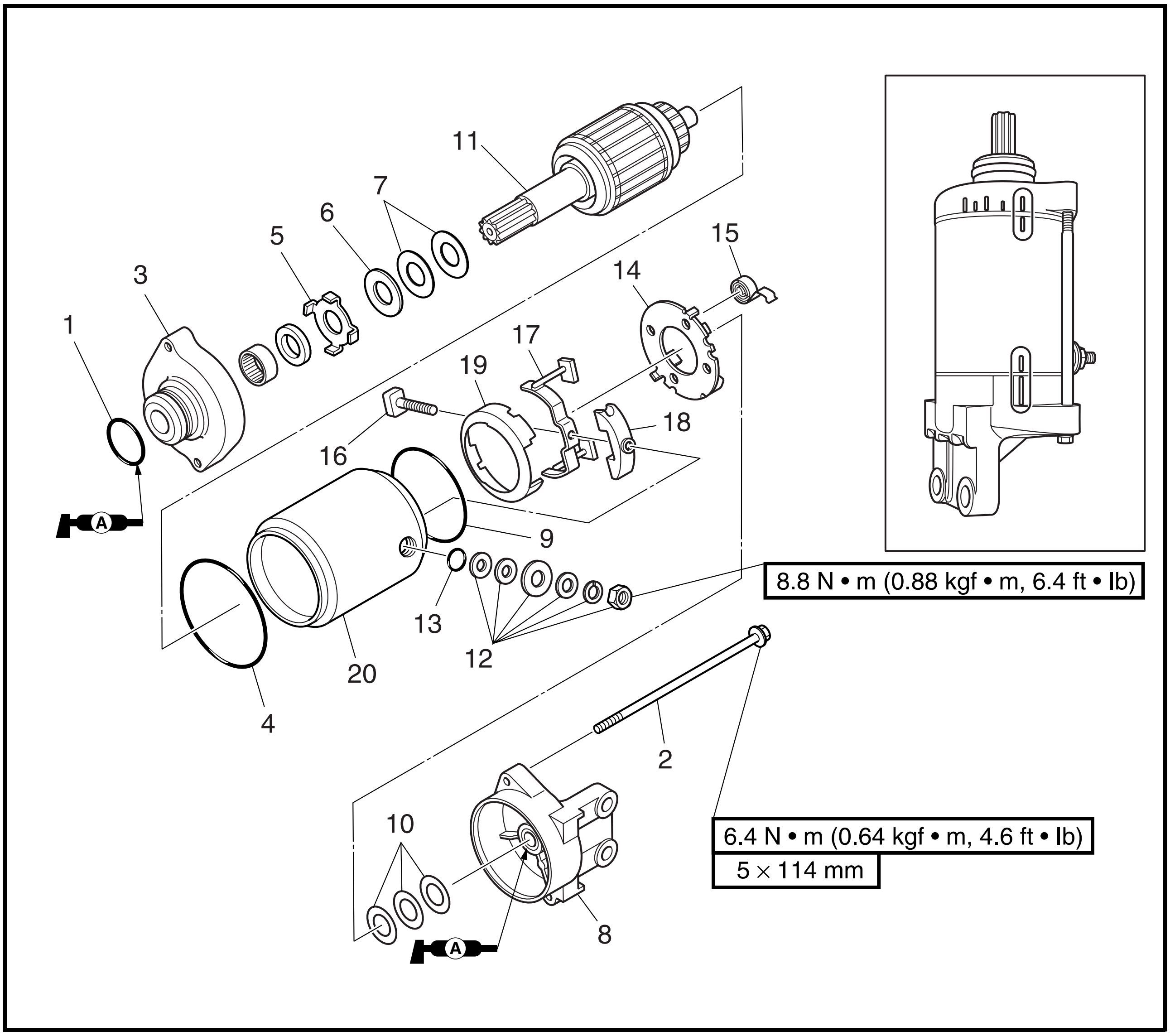
## THROTTLE POSITION SENSOR

Refer to “IGNITION SYSTEM”.

## ACCELERATOR POSITION SENSOR

Refer to “IGNITION SYSTEM”.

# STARTER MOTOR
## EXPLODED DIAGRAM

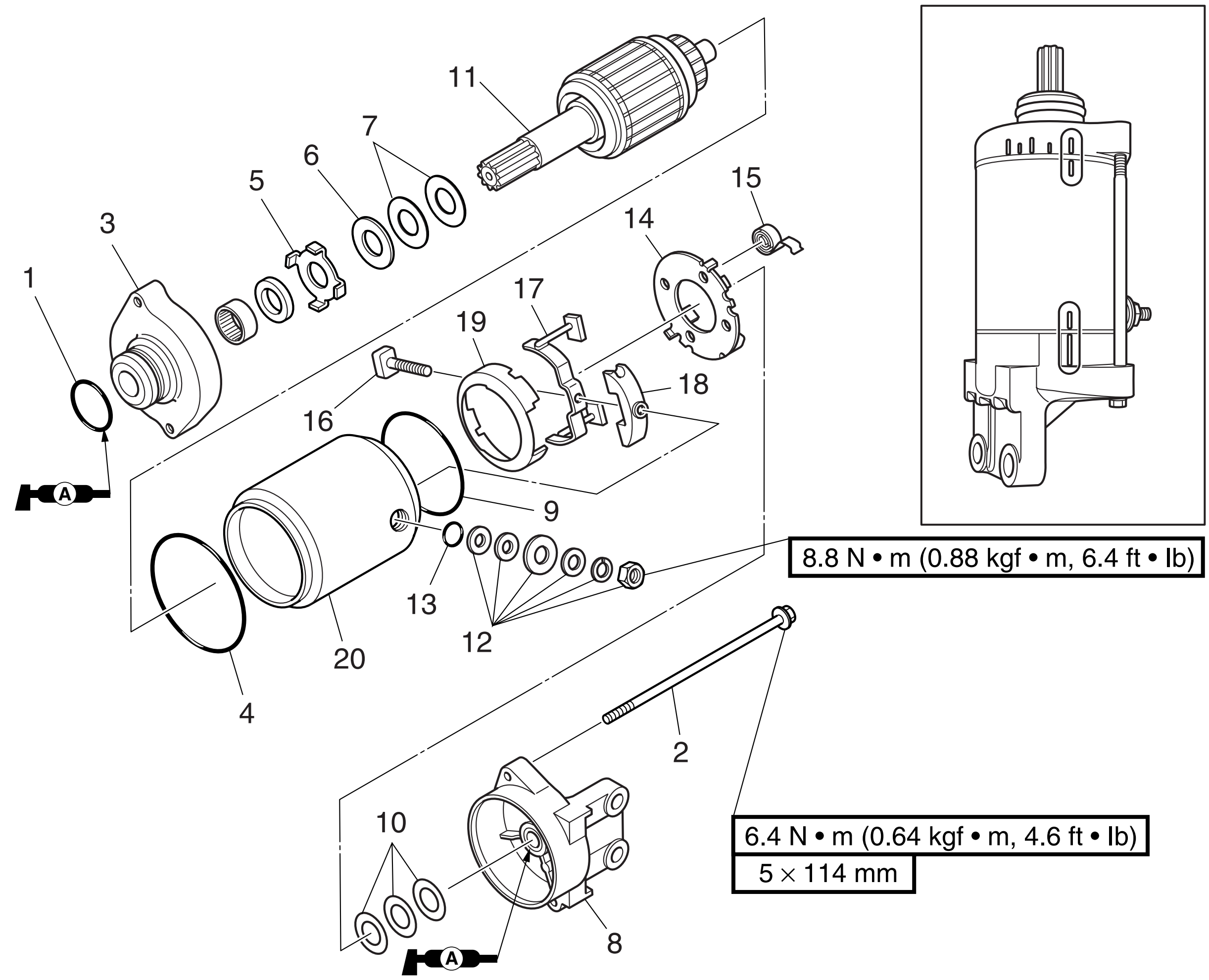



## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **STARTER MOTOR DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| | Starter motor | | Refer to "GENERATOR AND STARTER MOTOR" in Chapter 5. |
| 1 | O-ring | 1 | **Not reusable** |
| 2 | Bolt | 2 | |
| 3 | Starter motor front cover | 1 | |
| 4 | O-ring | 1 | **Not reusable** |
| 5 | Oil seal retainer | 1 | |
| 6 | Washer | 1 | |
| 7 | Shim | * | t = 0.2 mm, 0.5 mm |

*: As required

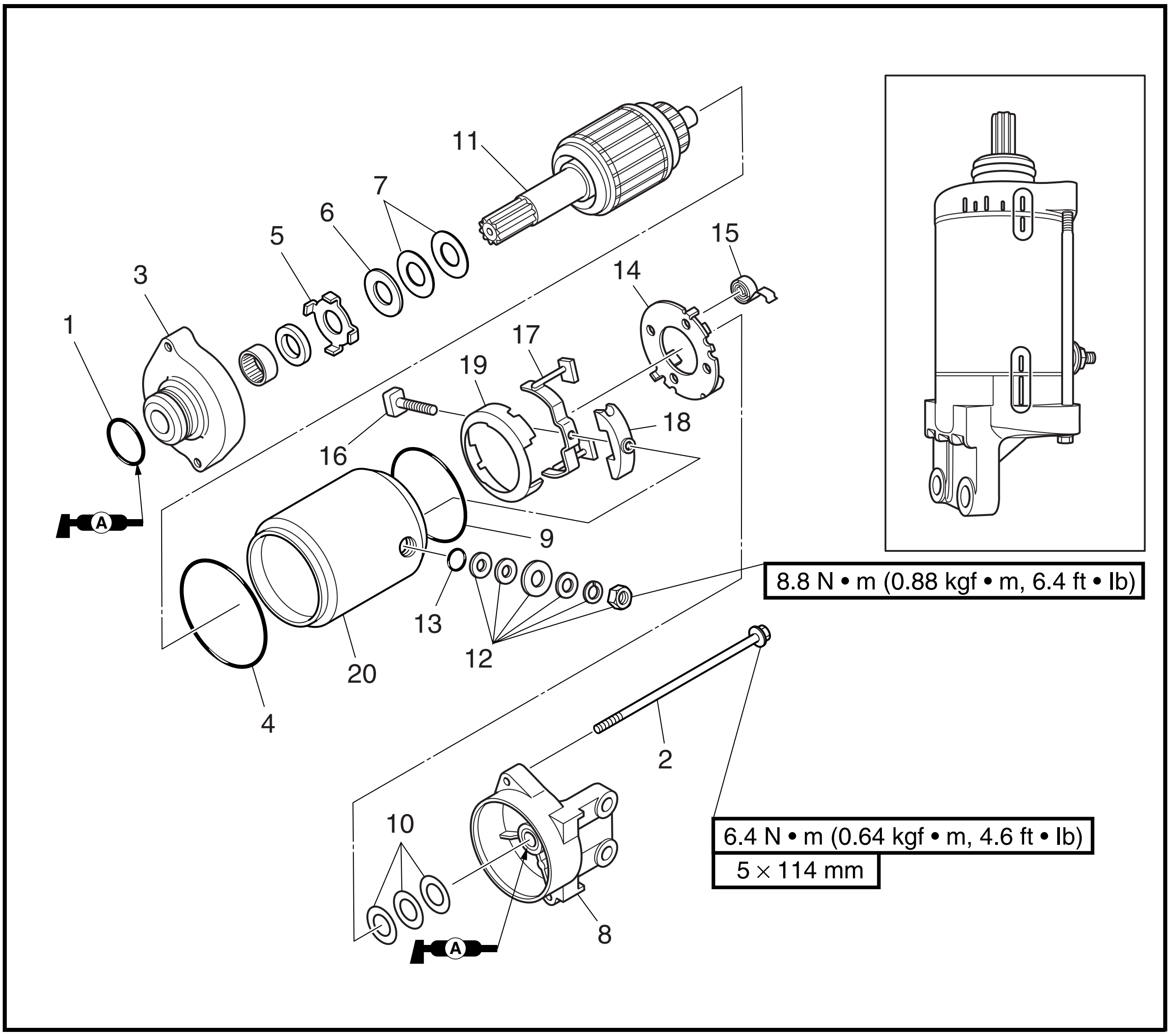
## EXPLODED DIAGRAM



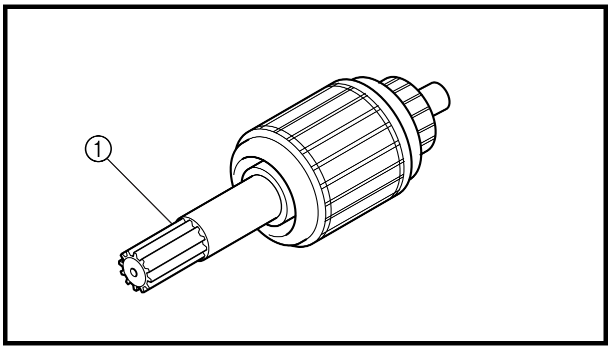

| Step | Procedure/Part name | Q’ty | Service points |
|---|---|---|---|
| 8 | Starter motor rear cover | 1 | |
| 9 | O-ring | 1 | **Not reusable** |
| 10 | Shim | * | t = 0.2 mm, 0.8 mm |
| 11 | Armature assembly | 1 | |
| 12 | Nut/spring washer/washer | 1/1/4 | |
| 13 | O-ring | 1 | **Not reusable** |
| 14 | Brush holder | 1 | |
| 15 | Brush spring | 4 | |
| 16 | Bolt | 1 | |
| 17 | Brush assembly | 1 | |

*: As required

## EXPLODED DIAGRAM



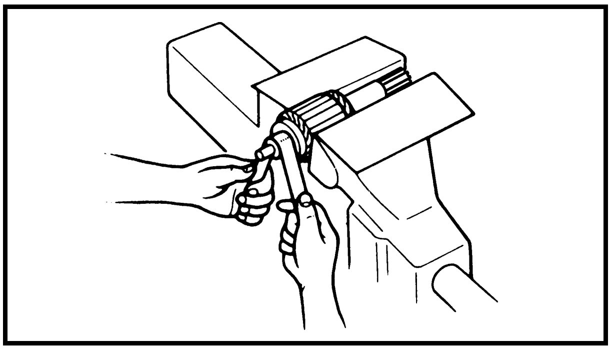

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 18 | Spacer | 1 | |
| 19 | Holder | 1 | |
| 20 | Starter motor yoke | 1 | |
| | | | Reverse the disassembly steps for assembly. |



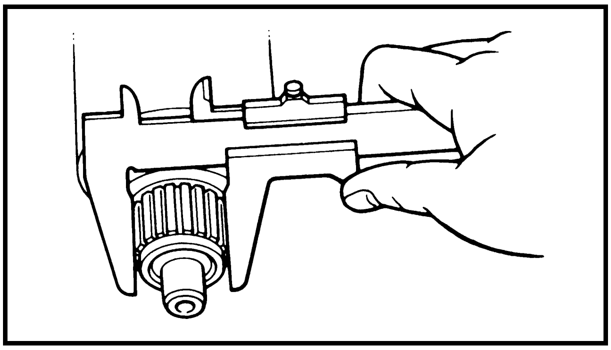

## SERVICE POINTS

### Armature inspection

1. Inspect:
   - Armature shaft ①
     Damage/wear → Replace.

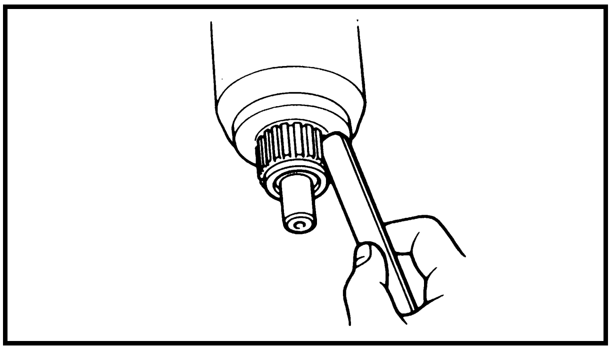


2. Inspect:
   - Commutator
     Dirt → Clean with 600-grit sandpaper.



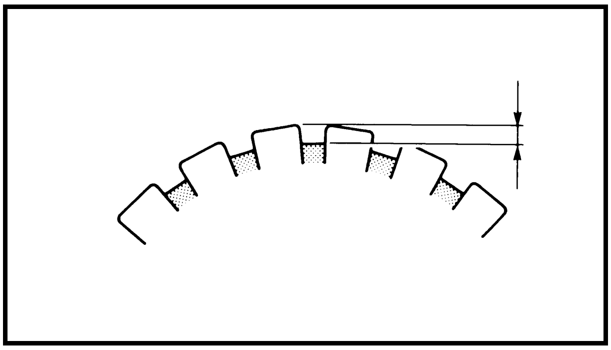
3. Measure:
   - Commutator diameter
     Below specification → Replace.

**Commutator diameter:**
**28.0 mm (1.10 in)**
**Limit:**
**27.0 mm (1.06 in)**



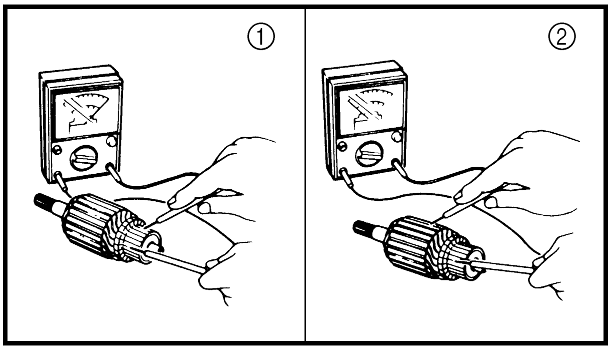
4. Check:
   - Commutator undercut
     Contaminants → Clean.

**NOTE:**
Remove all mica and metal particles with compressed air.



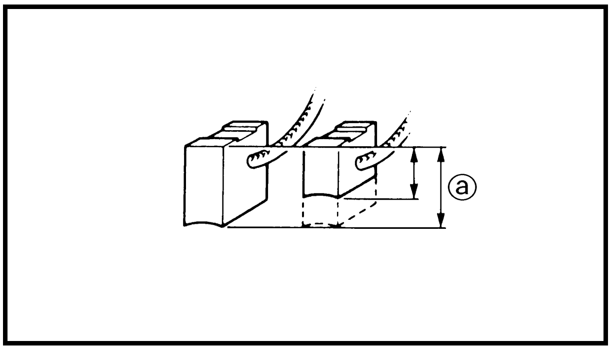
5. Measure:
   - Commutator undercut
     Below specification → Replace.

**Commutator undercut:**
**0.7 mm (0.03 in)**
**Limit:**
**0.2 mm (0.01 in)**




6. Inspect:
   - Armature coil continuity
     Out of specification → Replace.

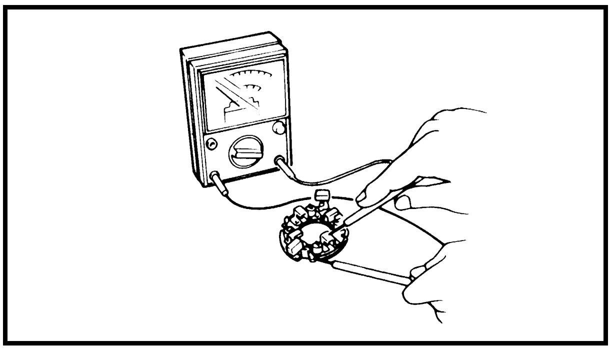
| Armature coil continuity: | |
|---|---|
| Commutator segments ① | Continuity |
| Segment - Laminations ② | No continuity |
| Segment - Armature shaft | No continuity |




**Brush holder inspection**

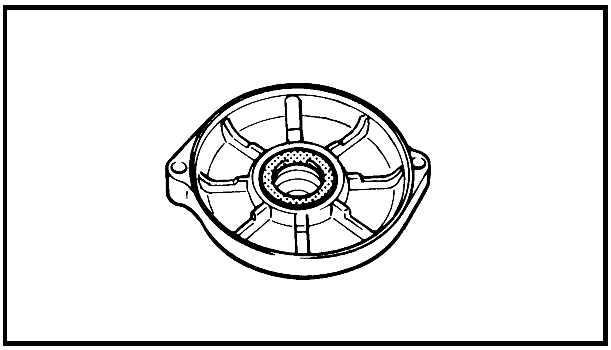
1. Measure:
   - Brush length ⓐ
     Below specification → Replace.

**Brush length:**
**12.5 mm (0.49 in)**
**Wear limit:**
**6.5 mm (0.26 in)**



2. Check:
   - Brush holder continuity
     Out of specification → Replace.

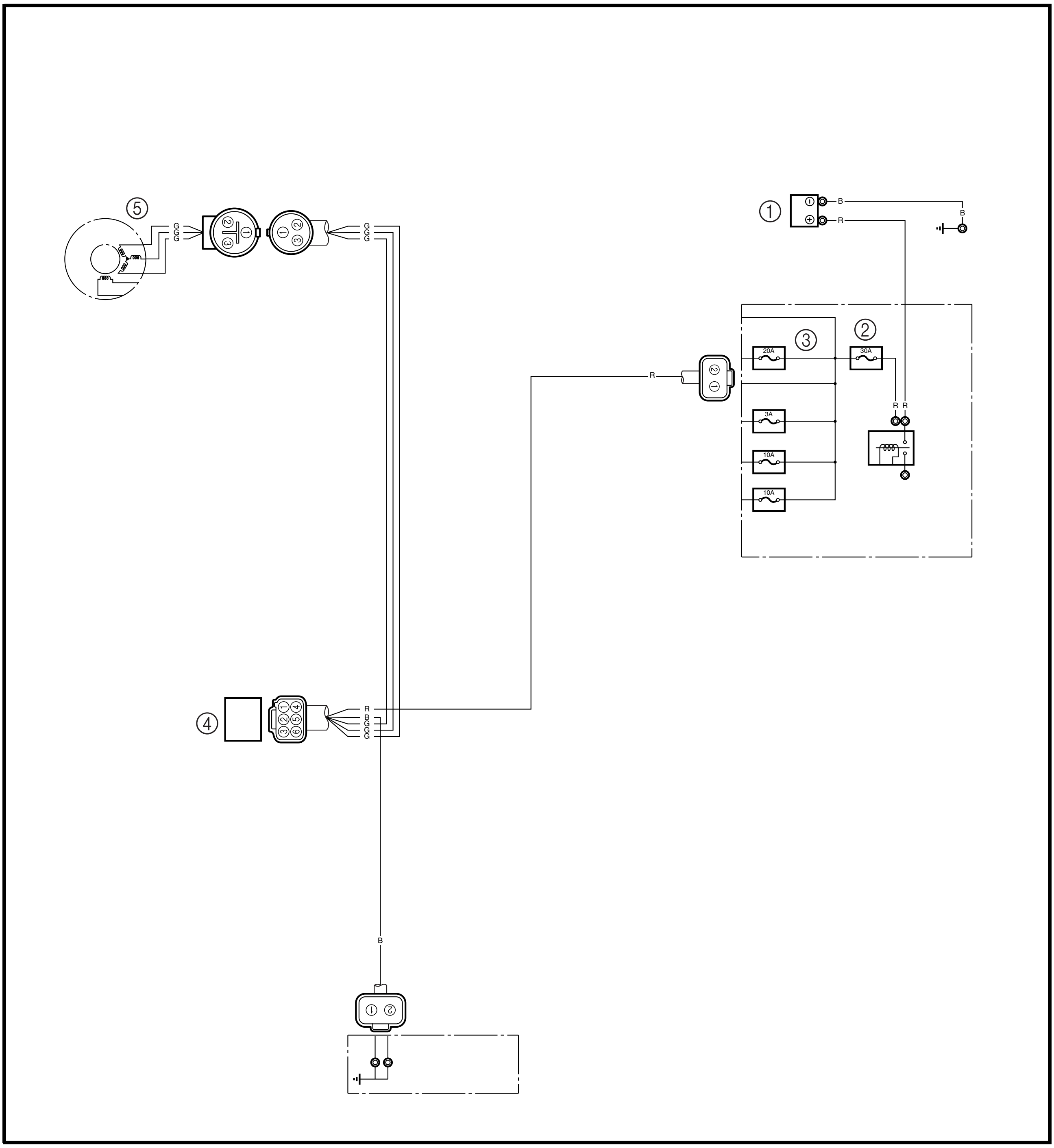
| Brush holder continuity: | |
|---|---|
| Brush holder - Base | No continuity |



**Starter motor front cover inspection**

1. Inspect:
   - Starter motor front cover oil seal
     Damage/wear → Replace the starter motor front cover.

# CHARGING SYSTEM
## WIRING DIAGRAM




① Battery
② Fuse (30 A)
③ Fuse (20 A)
④ Rectifier/regulator
⑤ Lighting coil

B : Black
G : Green
R : Red

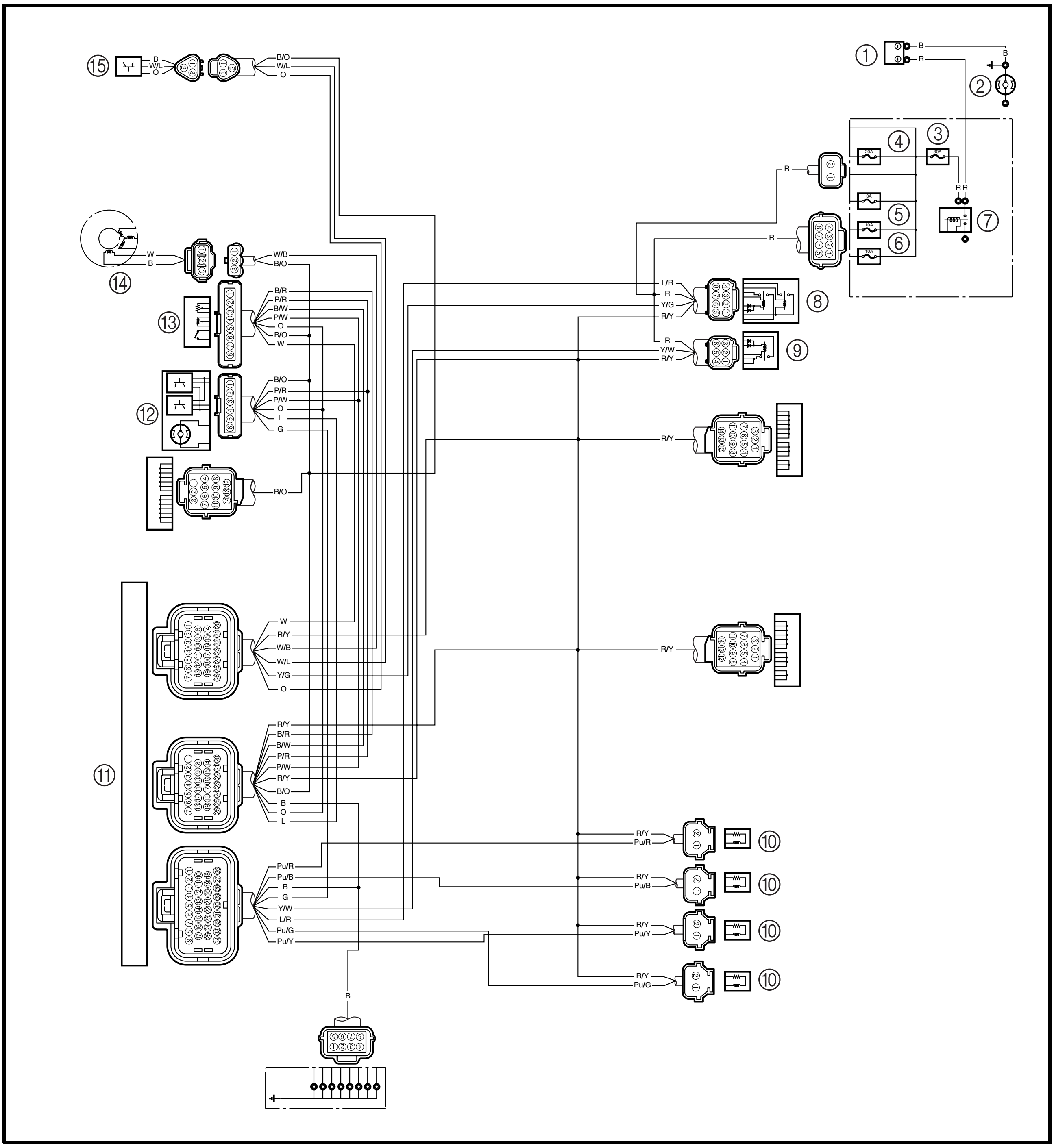
### FUSE
Refer to "STARTING SYSTEM".

### BATTERY
Refer to "ELECTRICAL" in Chapter 3.

### LIGHTING COIL
Refer to "IGNITION SYSTEM".

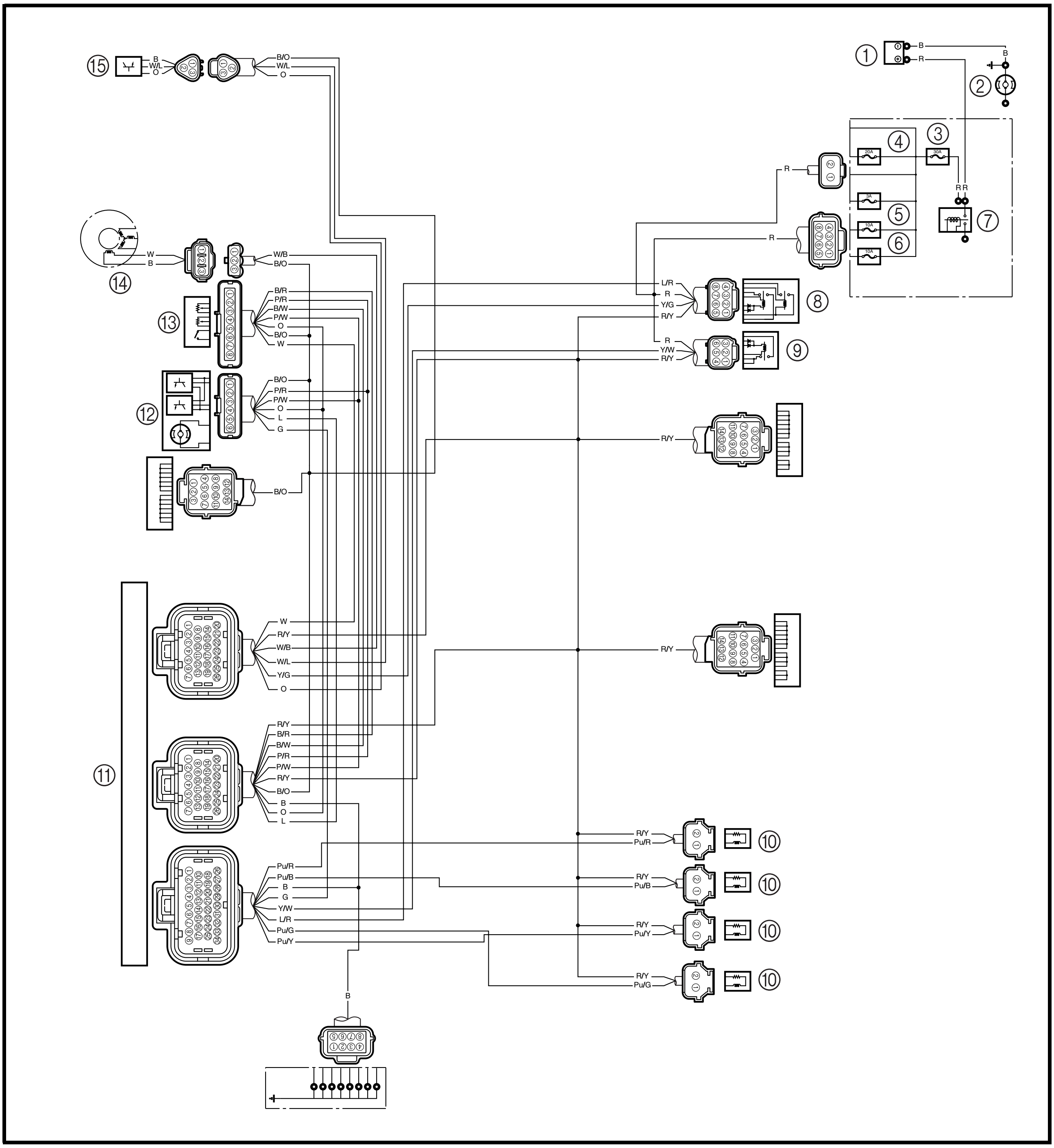
### RECTIFIER/REGULATOR
Refer to "IGNITION SYSTEM".

# OFF THROTTLE STEERING SYSTEM
## WIRING DIAGRAM

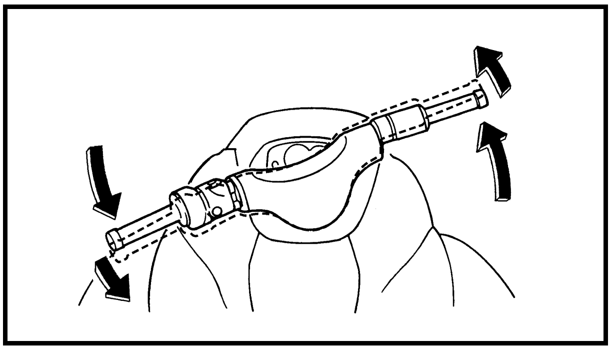


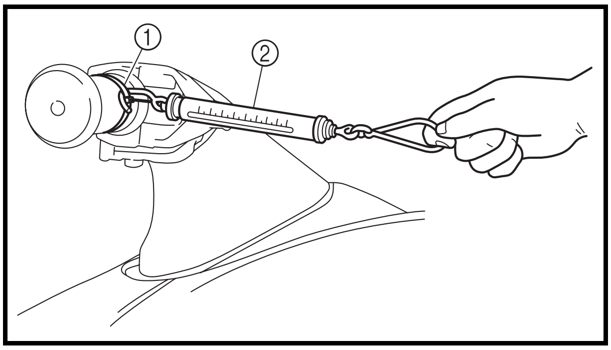

① Battery
② Starter motor
③ Fuse (30 A)
④ Fuse (20 A)
⑤ Fuse (10 A)
⑥ Fuse (10 A)
⑦ Starter relay
⑧ Main and fuel pump relay
⑨ Electronic control throttle valve relay
⑩ Fuel injector
⑪ ECM
⑫ Throttle body assembly
⑬ Accelerator position sensor
⑭ Pickup coil
⑮ Steering sensor

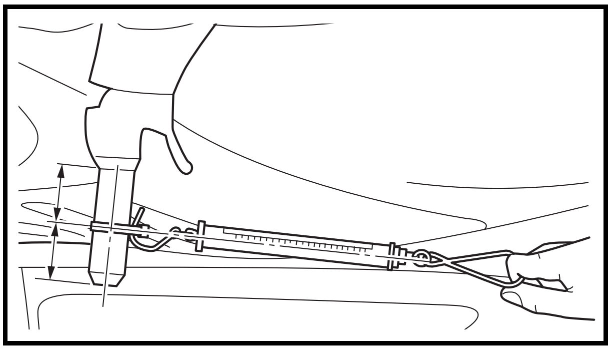
## WIRING DIAGRAM



| | | | | | |
|---|---|---|---|---|---|
| B | : Black | L/R | : Blue/red | W/L | : White/blue |
| G | : Green | P/R | : Pink/red | Y/G | : Yellow/green |
| L | : Blue | P/W | : Pink/white | Y/W | : Yellow/white |
| O | : Orange | Pu/B | : Purple/black | | |
| R | : Red | Pu/G | : Purple/green | | |
| W | : White | Pu/R | : Purple/red | | |
| B/O | : Black/orange | Pu/Y | : Purple/yellow | | |
| B/R | : Black/red | R/Y | : Red/yellow | | |
| B/W | : Black/white | W/B | : White/black | | |





## STEERING SENSOR

1. Check:
   - Steering sensor
     Malfunction → Replace the steering sensor.

**Checking steps:**
- Turn the handlebar all the way to the left or right, and then release it.
- Install a plastic tie ① loosely around the center of the handlebar grip as shown.
- Hook a spring gauge ② onto the plastic tie.
- Hold the spring gauge at a 90° angle from the handlebar, and then pull the spring gauge with a force of 10 kgf (22 lb).

| When handlebar pulled | When handlebar not pulled |
|---|---|
| ON | OFF |

- Check that the following is displayed in the "Engine Monitor" window of the Yamaha Diagnostic System.
- Use the same procedure to check that the steering sensor operates correctly when the handlebar is turned to both the left and right. Replace the steering sensor if it is a malfunction.

## ECM

Refer to "IGNITION SYSTEM".

## PICKUP COIL

Refer to "IGNITION SYSTEM".

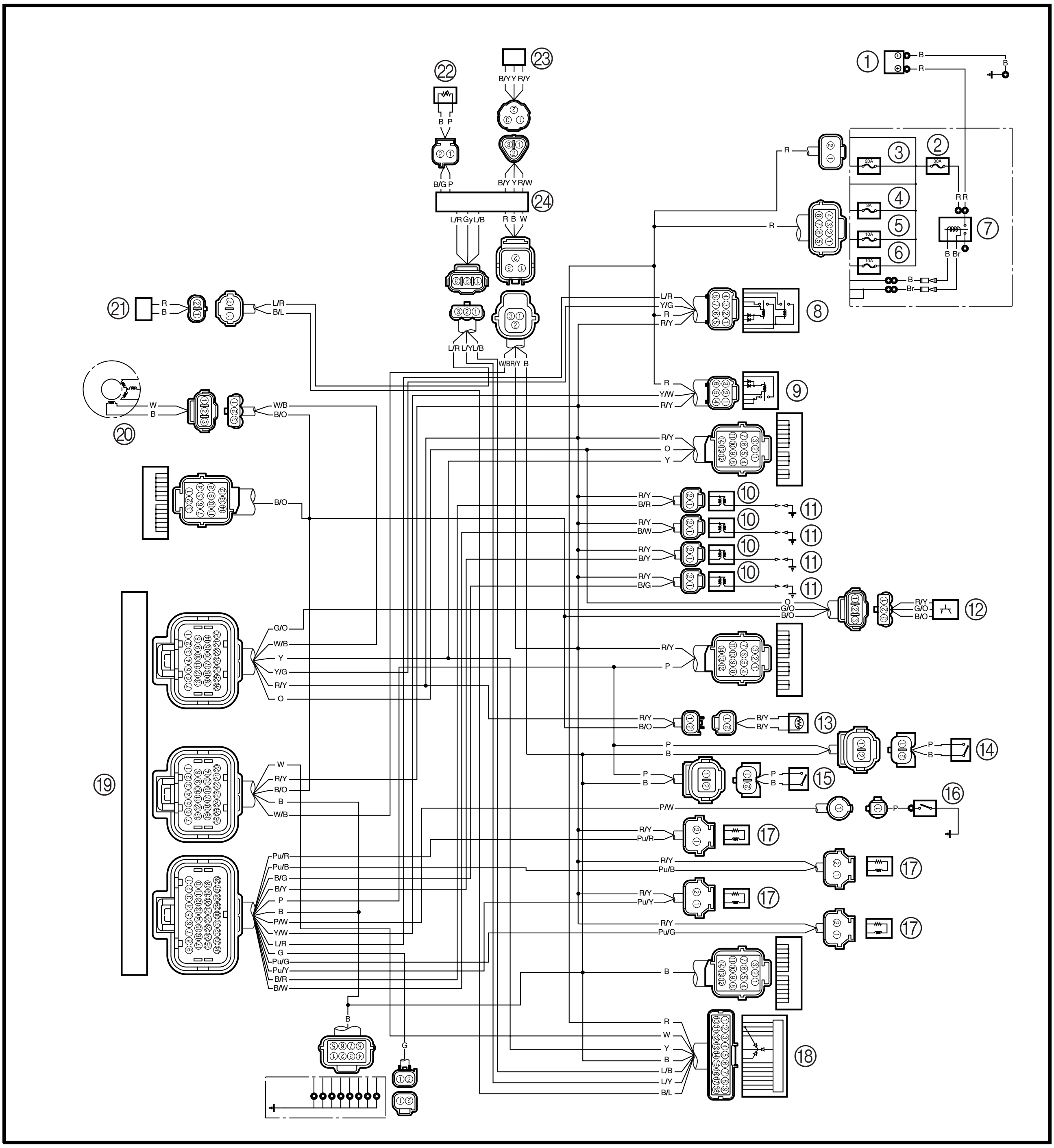
## THROTTLE POSITION SENSOR

Refer to "IGNITION SYSTEM".

## ACCELERATOR POSITION SENSOR

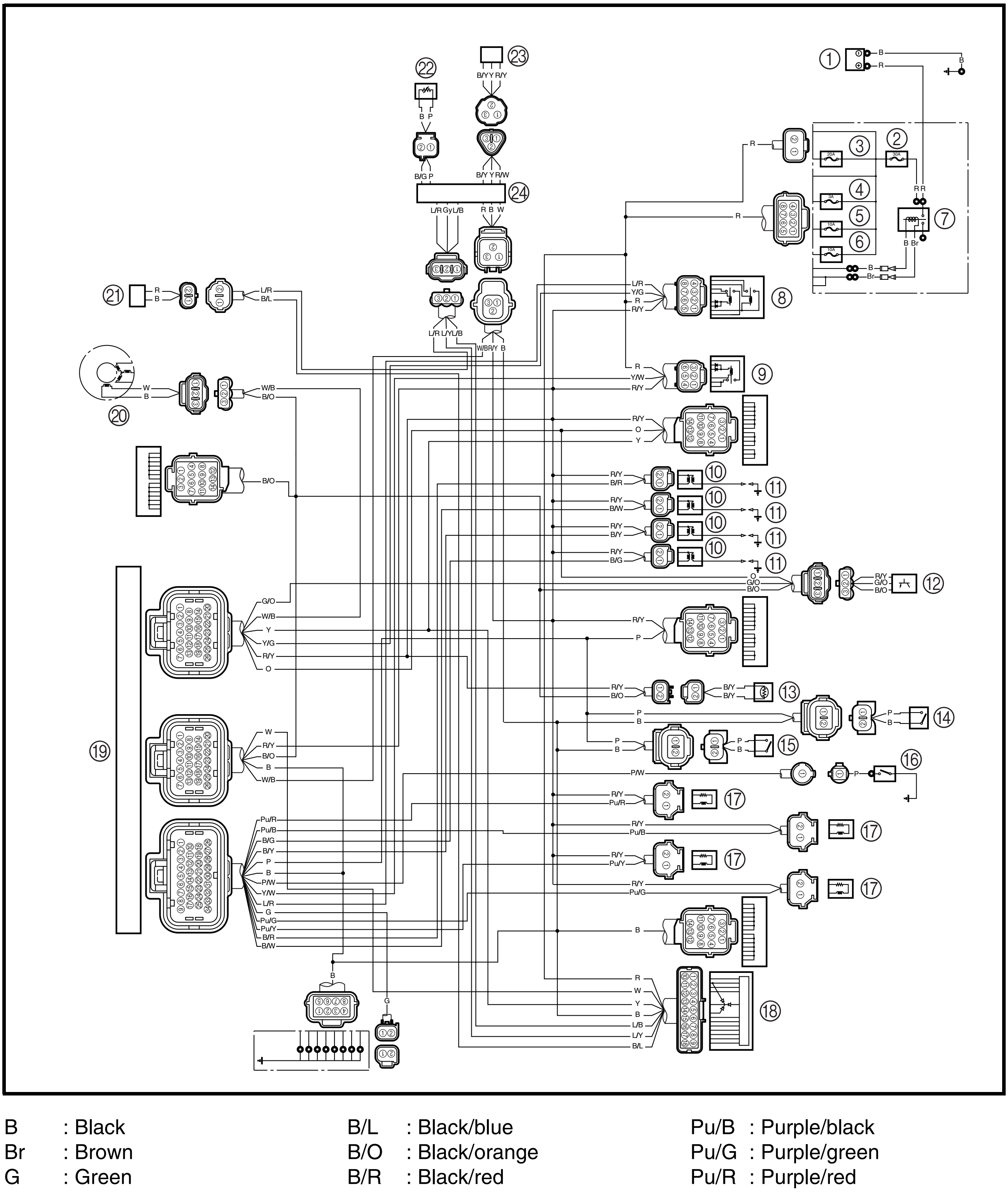
Refer to "IGNITION SYSTEM".

# INDICATION SYSTEM
## WIRING DIAGRAM



① Battery
② Fuse (30 A)
③ Fuse (20 A)
④ Fuse (3 A)
⑤ Fuse (10 A)
⑥ Fuse (10 A)
⑦ Starter relay
⑧ Main and fuel pump relay
⑨ Electronic control throttle valve relay
⑩ Ignition coil
⑪ Spark plug
⑫ Cam position sensor
⑬ Engine temperature sensor
⑭ Thermoswitch (engine)
⑮ Thermoswitch (exhaust)
⑯ Oil pressure switch
⑰ Fuel injector
⑱ Remote control unit (Deluxe model only)
⑲ ECM
⑳ Pickup coil
㉑ Buzzer
㉒ Fuel sender
㉓ Speed sensor
㉔ Multifunction meter

## WIRING DIAGRAM



| | | | | | |
|---|---|---|---|---|---|
| B | : Black | B/L | : Black/blue | Pu/B | : Purple/black |
| Br | : Brown | B/O | : Black/orange | Pu/G | : Purple/green |
| G | : Green | B/R | : Black/red | Pu/R | : Purple/red |
| Gy | : Gray | B/W | : Black/white | Pu/Y | : Purple/yellow |
| O | : Orange | B/Y | : Black/yellow | R/W | : Red/white |
| P | : Pink | G/O | : Green/orange | R/Y | : Red/yellow |
| R | : Red | L/B | : Blue/black | W/B | : White/black |
| W | : White | L/R | : Blue/red | Y/G | : Yellow/green |
| Y | : Yellow | L/Y | : Blue/yellow | Y/W | : Yellow/white |
| B/G | : Black/green | P/W | : Pink/white | | |

## FUSE

Refer to "STARTING SYSTEM".

## BATTERY

Refer to "ELECTRICAL" in Chapter 3.

## MAIN AND FUEL PUMP RELAY

Refer to "IGNITION SYSTEM".

## ECM

Refer to "IGNITION SYSTEM".

## ENGINE TEMPERATURE SENSOR

Refer to "IGNITION SYSTEM".

## THERMOSWITCH (ENGINE)

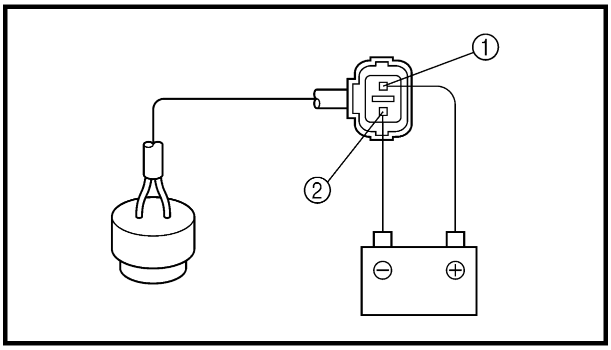
Refer to "IGNITION SYSTEM".

## THERMOSWITCH (EXHAUST)

Refer to "IGNITION SYSTEM".

## REMOTE CONTROL UNIT (DELUXE MODEL ONLY)

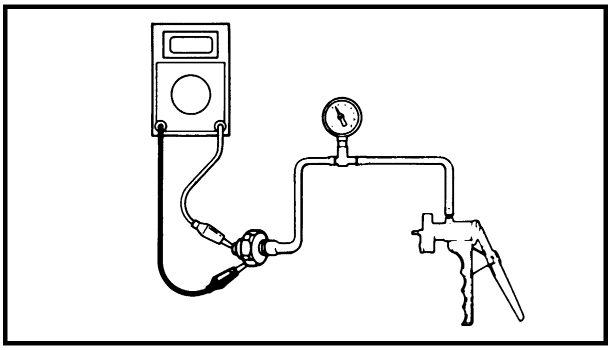
Refer to "REMOTE CONTROL SYSTEM (DELUXE MODEL ONLY)".




## BUZZER

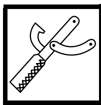
1. Check:
   - Buzzer
     Buzzer does not sound → Replace.

| **Checking steps:**<br>• Connect the battery (12 V) to the buzzer coupler as shown. |
|---|
| **Battery positive terminal →**<br>**Red (R) terminal ①**<br>**Battery negative terminal →**<br>**Black (B) terminal ②** |

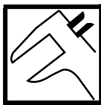


## OIL PRESSURE SWITCH

1. Measure:
   - Oil pressure switch continuity
     Out of specification → Replace.



**Lower unit pressure/vacuum tester:**
**YB-35956-A**
**Vacuum/pressure pump gauge set:**
**90890-06756**



**Oil pressure switch continuity pressure:**
**128 kPa (1.28 kgf/cm², 18.6 psi) – 167 kPa (1.67 kgf/cm², 24.2 psi)**

## MULTIFUNCTION METER

### Multifunction meter

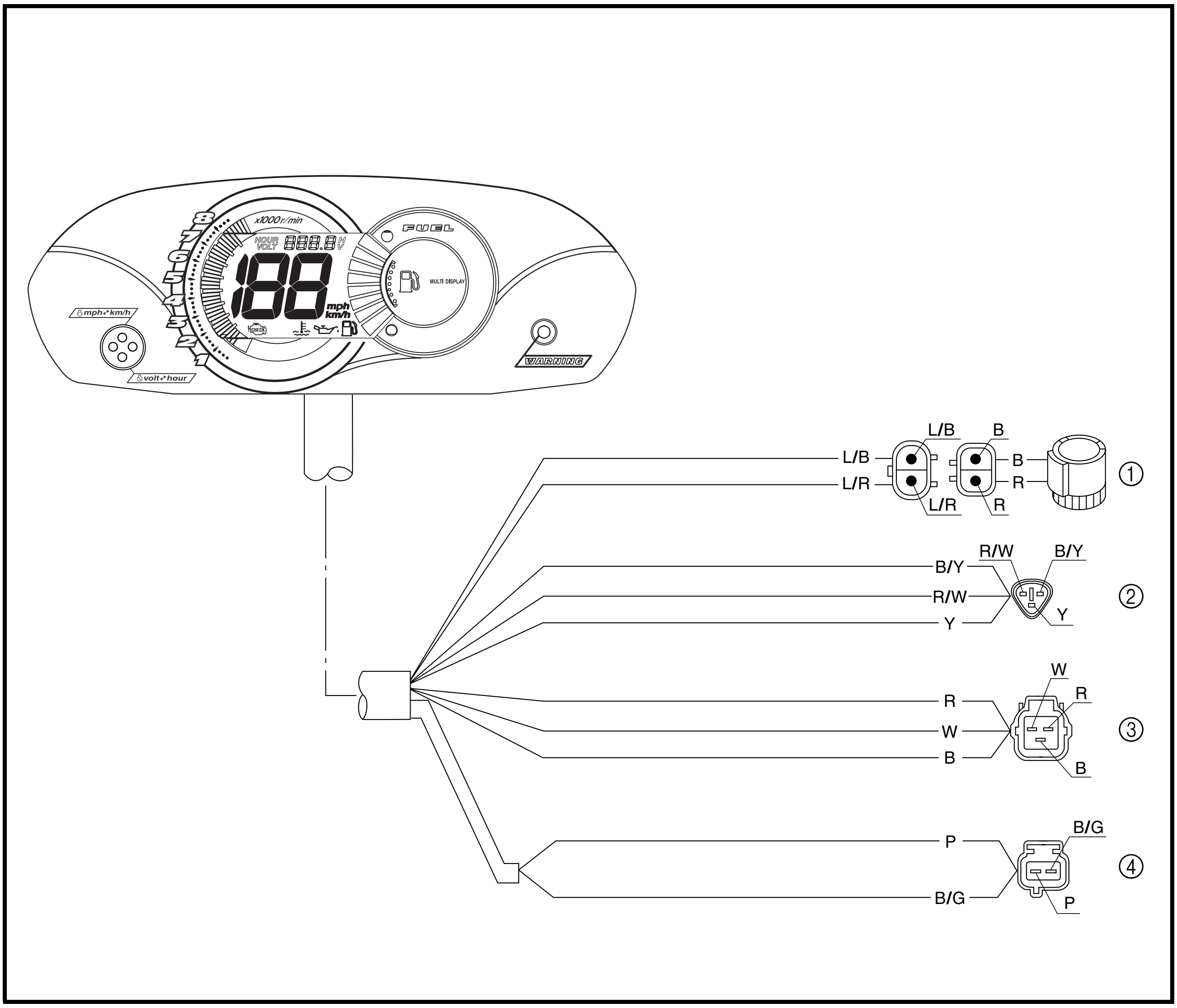
1. Check:
   - Multifunction meter
     Cracked meter housing → Replace the multifunction meter.
     Meter is fogged/shows signs of water intrusion → Replace the multifunction meter.

## MULTIFUNCTION METER REMOVAL

Refer to “ENGINE HATCH COVER” in Chapter 8.

**Display function (Sport model only)**

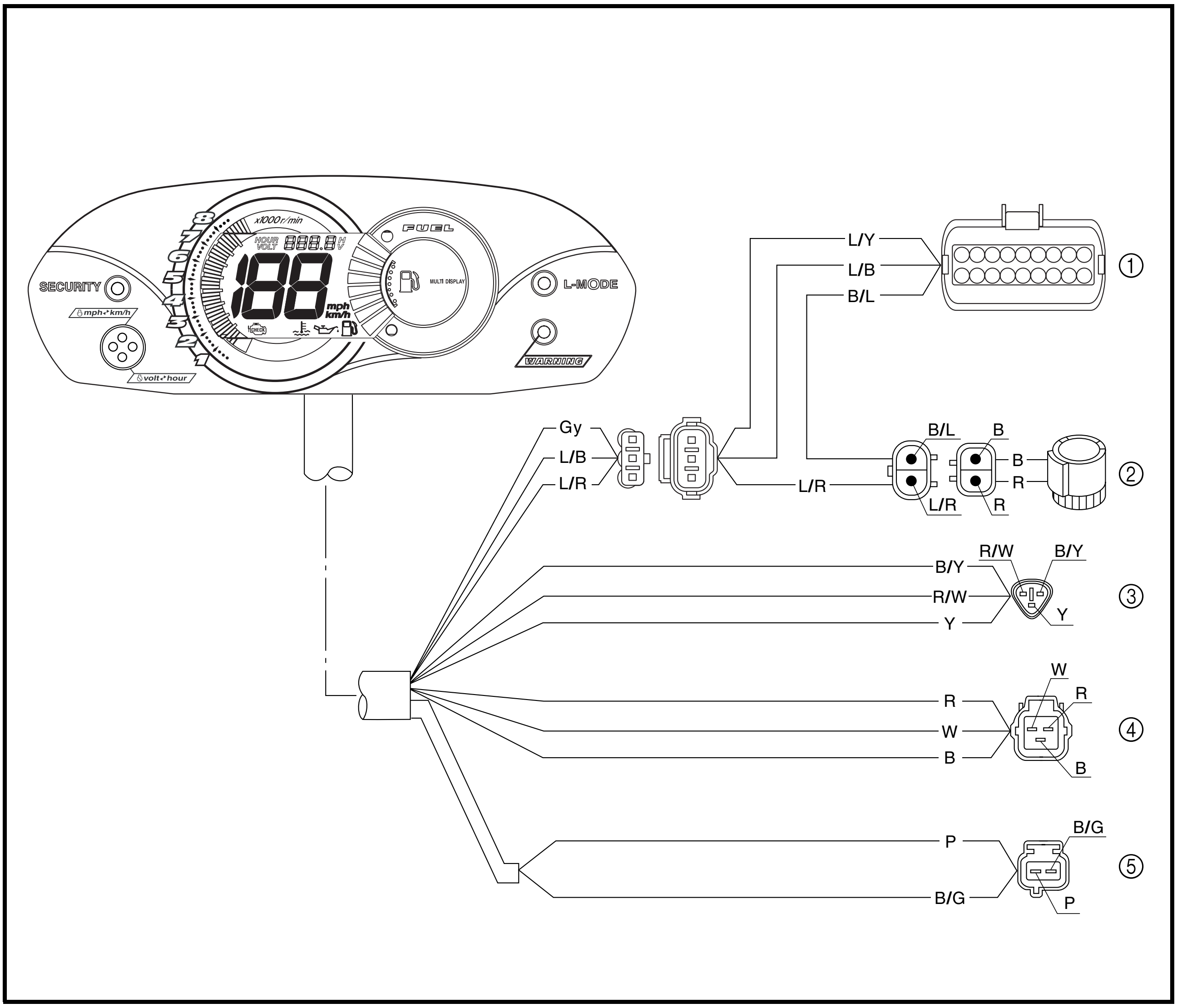
1. Check:
   - Display function
     Does not operate → Replace the multi-function meter.




| | | |
|---|---|---|
| ① Buzzer | B : Black | B/G : Black/green |
| ② Speed sensor | P : Pink | B/Y : Black/yellow |
| ③ ECM | R : Red | L/B : Blue/black |
| ④ Fuel sender | W : White | L/R : Blue/red |
| | Y : Yellow | R/W : Red/white |

### Display function (Deluxe model only)

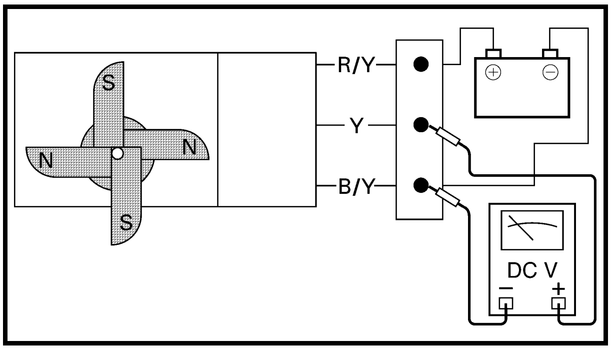
1. Check:
   - Display function
     Does not operate → Replace the multi-function meter.

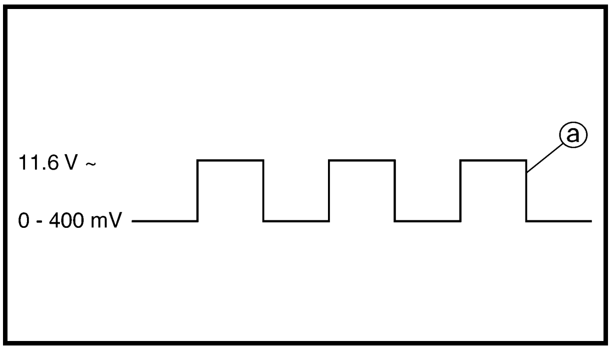



① Remote control unit
② Buzzer
③ Speed sensor
④ ECM
⑤ Fuel sender

B : Black
Gy : Gray
P : Pink
R : Red
W : White
Y : Yellow
B/G : Black/green

B/L : Black/blue
B/Y : Black/yellow
L/B : Blue/black
L/R : Blue/red
L/Y : Blue/yellow
R/W : Red/white




**Speedometer display**

1. Check:
   - Speedometer display
     Does not display → Measure the speed sensor output voltage and pulses.
2. Measure:
   - Speed sensor output voltage and pulses
     Out of specification → Repair or replace.
     Within specification → Replace the multifunction meter.

**Speed sensor output voltage (dependant on the paddle wheel position):**
**Less than 400 mV/**
**More than 11.6 V**
**Output pulse:**
**2 pulses/one-full turn**

**Measurement steps:**
- Apply DC 12 volts to the natural color three-pin connector (between the red/yellow and black/yellow leads).
- Rotate the paddle wheel by hand and measure the voltage between the black/yellow and yellow leads.

**NOTE:**
As the paddle wheel is rotated, a square-wave voltage signal ⓐ is produced.

- Two pulses occur every time the paddle wheel makes one-full turn.

**Tachometer display**

1. Check:
   - Tachometer display
     Does not display → Check the engine speed using the “Engine monitor” of the Yamaha Diagnostic System.
     Replace the multifunction meter.

**Hour meter display**

1. Check:
   - Hour meter display
     Does not display → Replace the multifunction meter.

**Voltage meter display**

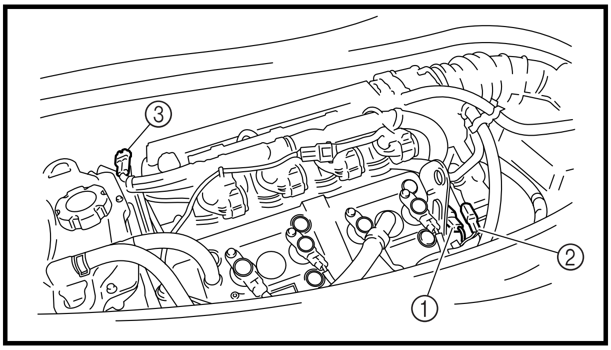
1. Check:
   - Voltage meter display
     Does not display → Check the battery voltage using the “Engine monitor” of the Yamaha Diagnostic System.
     Replace the multifunction meter.

**Low oil pressure warning indicator**

1. Check:
   - Low oil pressure warning indicator
     Does not come on → Check the oil pressure switch using the “Engine monitor” of the Yamaha Diagnostic System.
     Replace the multifunction meter.

**Fuel level meter display and fuel warning indicator**

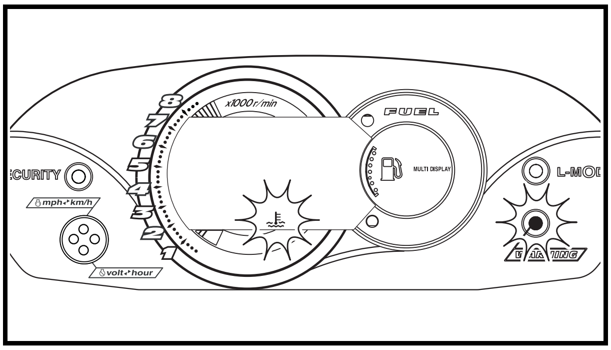
1. Check:
   - Fuel level meter display and fuel warning indicator
     Do not display → Measure the fuel sender resistance.
     If the fuel sender resistance is within specification, replace the multifunction meter.
2. Measure:
   - Fuel sender resistance
     Refer to “FUEL CONTROL SYSTEM”.

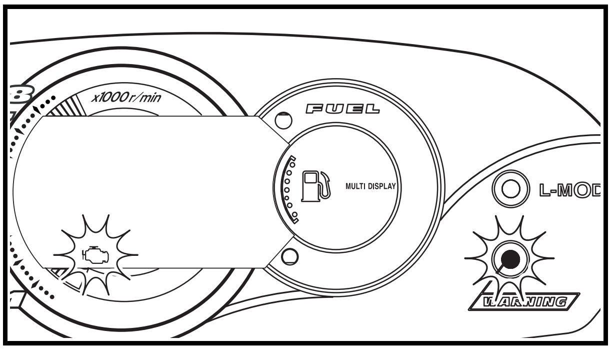



### Overheat warning indicator

1. Check:
   - Overheat warning indicator
     Does not come on → Replace the multifunction meter.

**Checking steps:**
- Start the engine.
- Disconnect the thermoswitch (engine) connector ① (blue), engine temperature sensor connector ② (black), or thermoswitch (exhaust) ③ connector.
- Connect the jumper lead to the female terminal of the disconnected connector.
- Check that the multifunction meter overheat warning indicator blinks, then comes on. The buzzer also begins to sound intermittently, then sounds continuously.

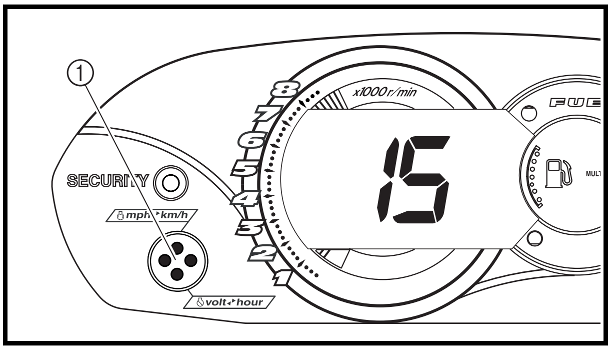



### Check engine warning indicator

1. Check:
   - Check engine warning indicator
     Does not come on → Replace the multifunction meter.

**Checking steps:**
- Start the engine.
- Disconnect the coupler of a sensor (e.g., engine temperature sensor) that normally activates the check engine warning indicator when a malfunction occurs.
- Check that the warning light and check engine warning indicator begin to blink and the buzzer sounds intermittently.



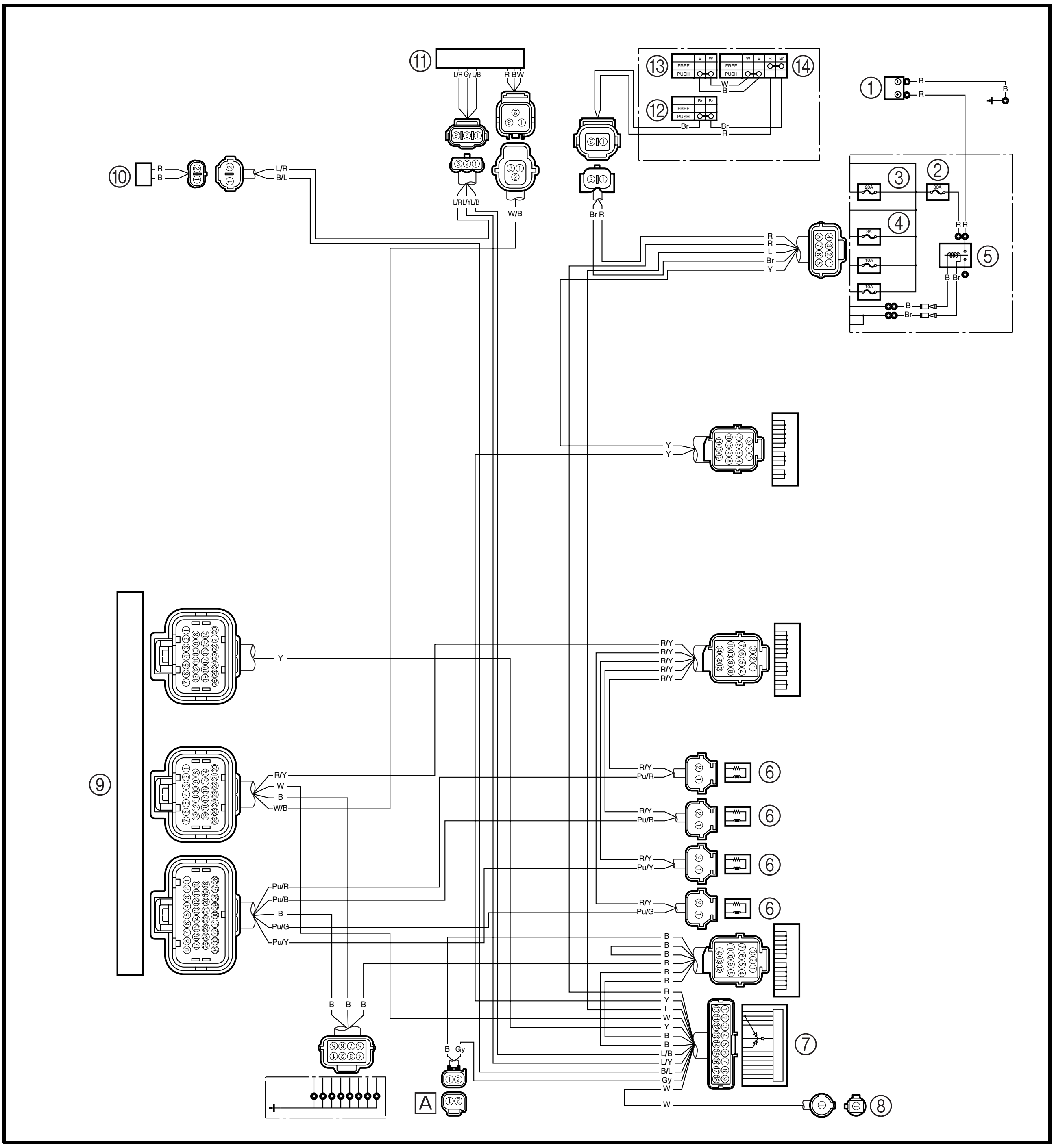

**Diagnostic display**

1. Check:
   - Diagnostic display
     Does not display → Replace the multi-function meter.

**Checking steps:**
- Start the engine.
- Disconnect the coupler of a sensor (e.g,. engine temperature sensor) that is normally displayed when a malfunction occurs. Refer to “SELF-DIAGNOSIS” in Chapter 9.
- Check that the check engine warning indicator comes on and that the buzzer sounds.
- Press the select switch ① for 8 seconds and check the error code indicated on the multifunction meter.

# REMOTE CONTROL SYSTEM (DELUXE MODEL ONLY)

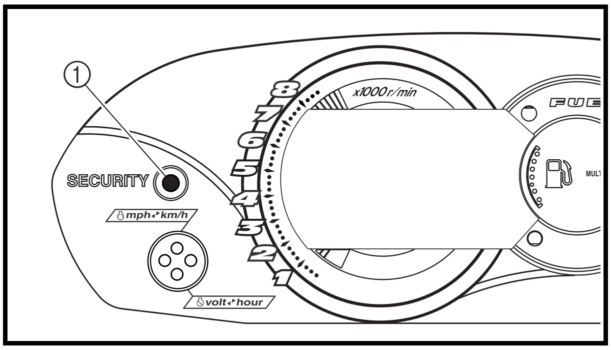
## WIRING DIAGRAM




① Battery
② Fuse (30 A)
③ Fuse (20 A)
④ Fuse (3 A)
⑤ Starter relay
⑥ Fuel injector
⑦ Remote control unit
⑧ Antenna
⑨ ECM
⑩ Buzzer
⑪ Multifunction meter
⑫ Start switch
⑬ Engine stop switch
⑭ Engine shut-off switch

A To entry box

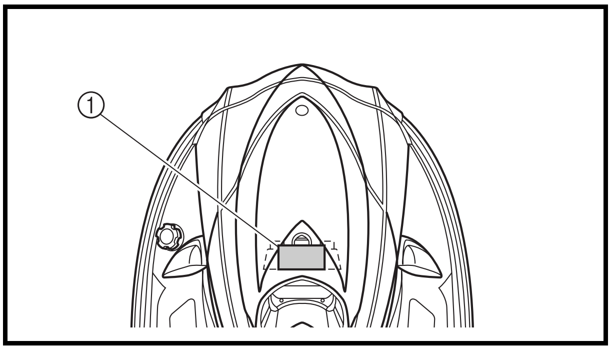
B : Black
Br : Brown
Gy : Gray
L : Blue
R : Red
W : White
Y : Yellow
B/L : Black/blue
L/B : Blue/black
L/R : Blue/red
L/Y : Blue/yellow
Pu/B : Purple/black
Pu/G : Purple/green
Pu/R : Purple/red
Pu/Y : Purple/yellow
R/Y : Red/yellow
W/B : White/black

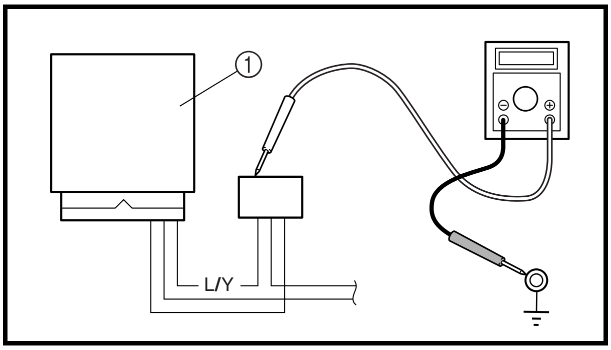



## REMOTE CONTROL SYSTEM

### Yamaha Security System indicator

1. Check:
   - Yamaha Security System indicator
     Check that the “SECURITY” indicator light ① comes on when the Yamaha Security System is deactivated (i.e., the engine can be started).
     Does not come on → Measure the remote control unit output voltage.

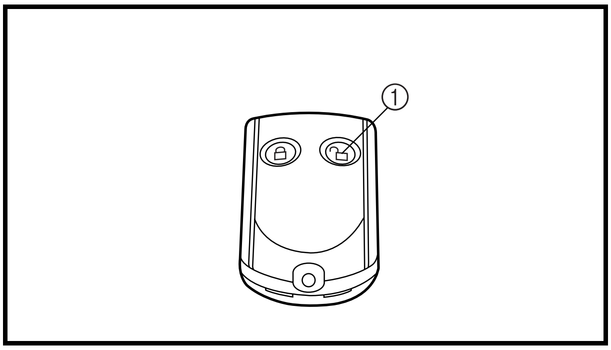





2. Measure:
   - Remote control unit output voltage
     Within specification → Replace the multifunction meter.
     Out of specification → Replace the remote control unit.

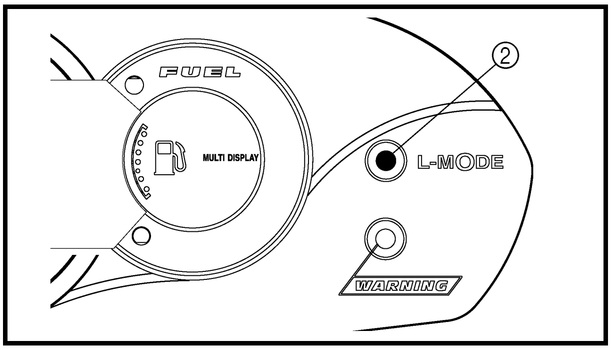
**Remote control unit output voltage:**
**Blue/yellow (L/Y) – ground**
**11–13 V**

**Measurement steps:**
- Disconnect the remote control unit ① coupler from the multifunction meter.
- Measure the remote control unit output voltage while pushing the unlock button of the remote control transmitter.

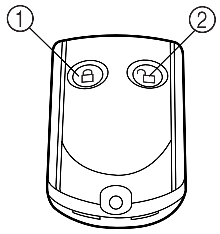


### Low-rpm mode indicator

1. Check:
   - Low-rpm mode indicator
     Does not come on → Replace the multifunction meter.




**Checking steps:**
- Press the unlock button ① of the remote control transmitter for more than 4 seconds to select the low-rpm mode.
- Check that the beeper sounds three times and that the “L-MODE” indicator light ② comes on.




**Checking the remote control transmitter**

1. Check:
   - Remote control transmitter
     Does not operate → Replace the remote control transmitter.

**Checking steps:**

**CAUTION:**

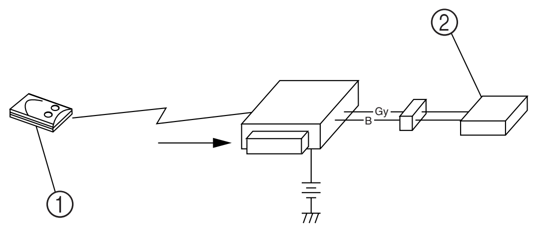
**If the buttons on the remote control transmitter are pushed but the transmitter does not operate, the battery may be low.**

- Press the lock button ① of the remote control transmitter. The beeper sounds once.
- Check that the “SECURITY” indicator light goes off and that the engine cannot be started.
- Press the unlock button ② of the remote control transmitter for a short time. The beeper sounds two or three times.
- Check that the “SECURITY” indicator light comes on and that the engine can be started.
- Press the unlock button for more than 4 seconds to select the low-rpm mode.
- Check that the beeper sounds three times and that the “L-MODE” indicator light comes on.

| Number of beeps | Yamaha Security System mode | Engine startability |
|---|---|---|
| 1 beep | Lock | Unable |
| 2 beeps | Unlock (normal mode) | Able |
| 3 beeps | Unlock (low-rpm mode) | Able |

**NOTE:**

- If the start switch or the remote control transmitter is not operated for more than 25 seconds, the multifunction meter display and the “L-MODE” indicator light will go off. To change the modes again, press the lock button for a short time, and then start the procedures from the lock mode.
- While the engine is running, input is not received from the remote control transmitter.




### Transmitter registration

1. Register:
   - Remote control transmitter ①
     ID codes can be added or re-registered by connecting the entry box ②.

**Registration steps:**
- Connect the entry box.
- Transmit the ID code from the remote control transmitter to be registered.

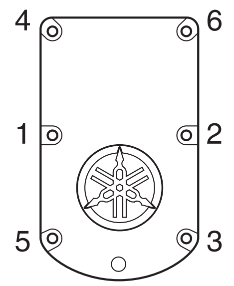
**NOTE:**
The remote control transmitters can be registered in any sequence, regardless of whether they are original equipment or additional transmitters.

- At this time, the system enters the registration mode to register the first code. All existing ID codes will be deleted from the EEPROM.
- The "SECURITY" indicator light flashes when the registration of the ID code has been completed. (If the registration could not be completed, the "SECURITY" indicator light comes on. Re-transmit the ID code.)
- After confirming that the registration of the ID code has been completed using the "SECURITY" indicator light, transmit the next ID code.
- Register the ID codes for up to five remote control transmitters.
- After ID code registration has been completed, disconnect the entry box to exit the registration mode.

**Replacing of the transmitter battery**

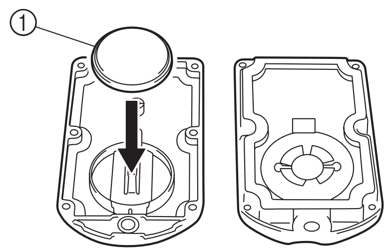
**CAUTION:**

- **Do not allow any water, dust, or dirt to enter the remote control transmitter case when replacing the battery.**
- **Make sure that no foreign material is trapped between the upper case and lower case of the remote control transmitter during assembly.**



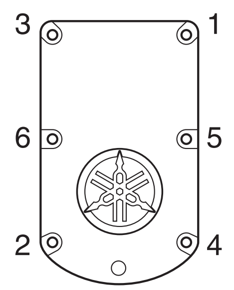

1. Remove:
   - Cover

**NOTE:**
Loosen the transmitter cover screws in the sequence shown.



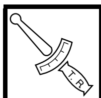

2. Install:
   - Battery ①

**NOTE:**
Install the battery (CR2016) with the positive side facing down.




3. Install:
   - Cover

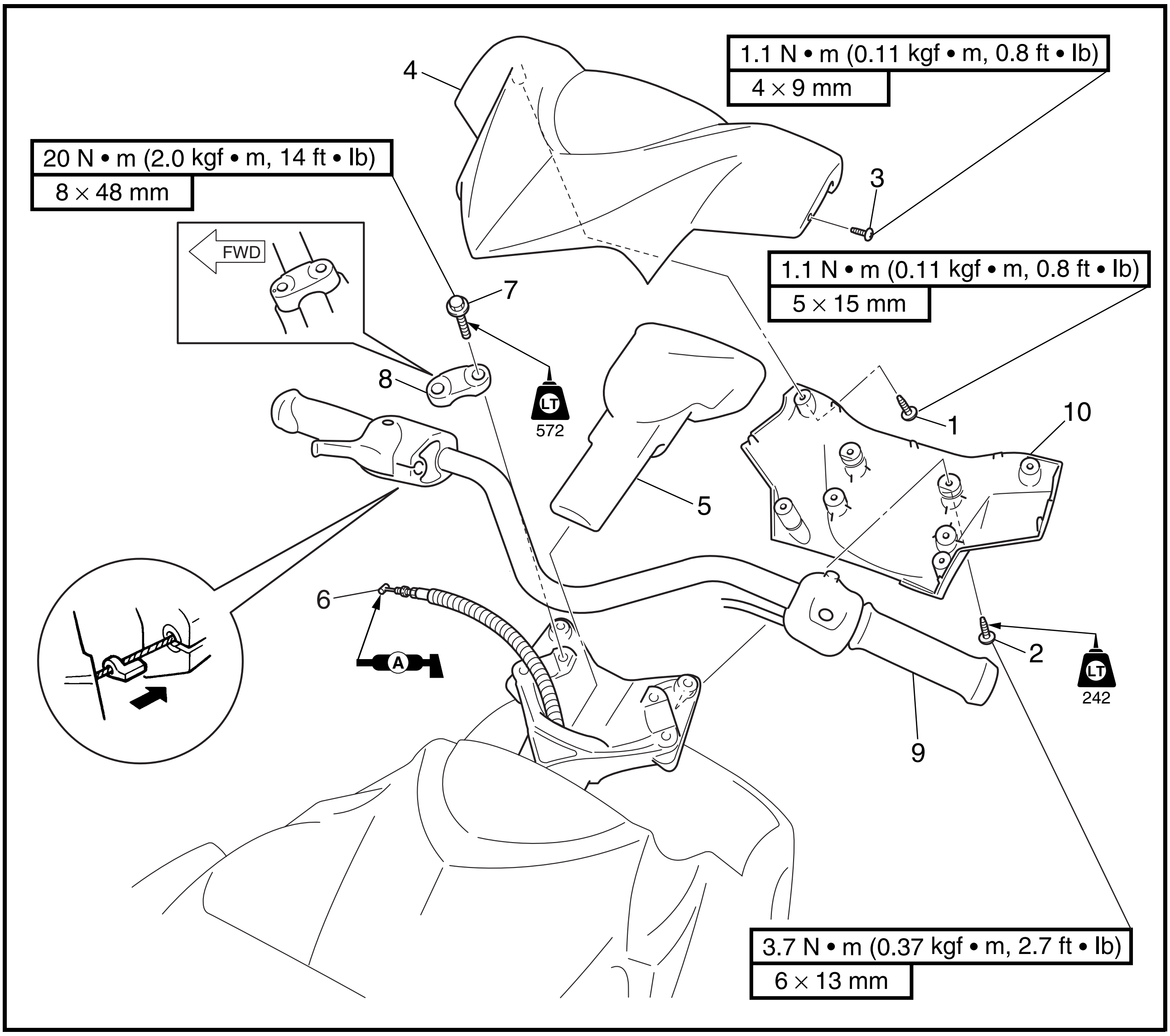
**NOTE:**
Tighten the transmitter cover screws in the sequence shown.



**Transmitter cover screw:**
**0.1 N • m**
**(0.01 kgf • m, 0.1 ft • lb)**

# CHAPTER 8
# HULL AND HOOD

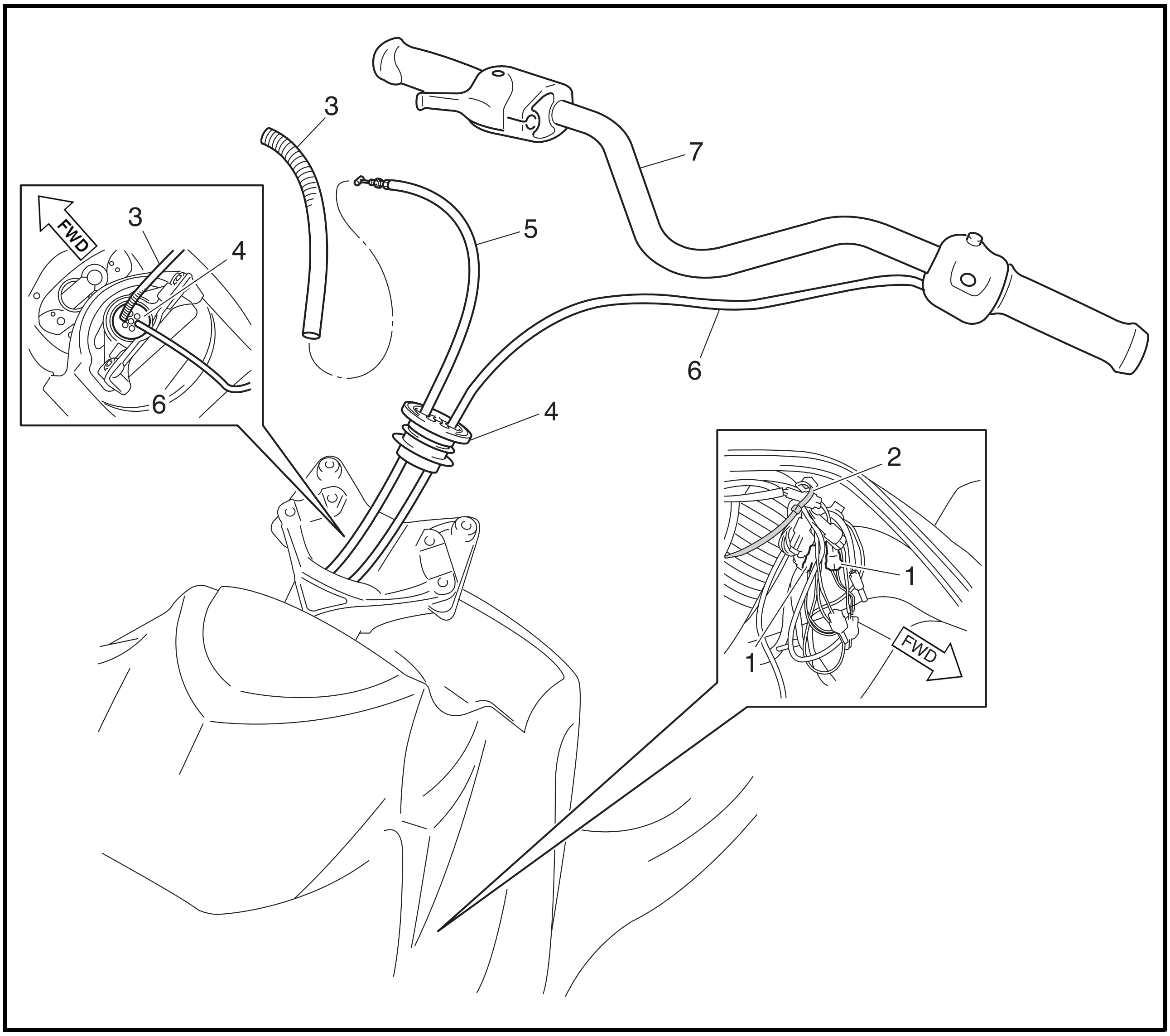
# HANDLEBAR
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **HANDLEBAR REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Screw | 4 | |
| 2 | Screw | 4 | |
| 3 | Screw | 2 | |
| 4 | Upper handlebar cover | 1 | |
| 5 | Pad | 1 | |
| 6 | Throttle cable | 1 | |
| 7 | Bolt | 4 | |
| 8 | Upper handlebar holder | 2 | |
| 9 | Handlebar assembly | 1 | |
| 10 | Lower handlebar cover | 1 | |
| | | | Reverse the removal steps for installation. |

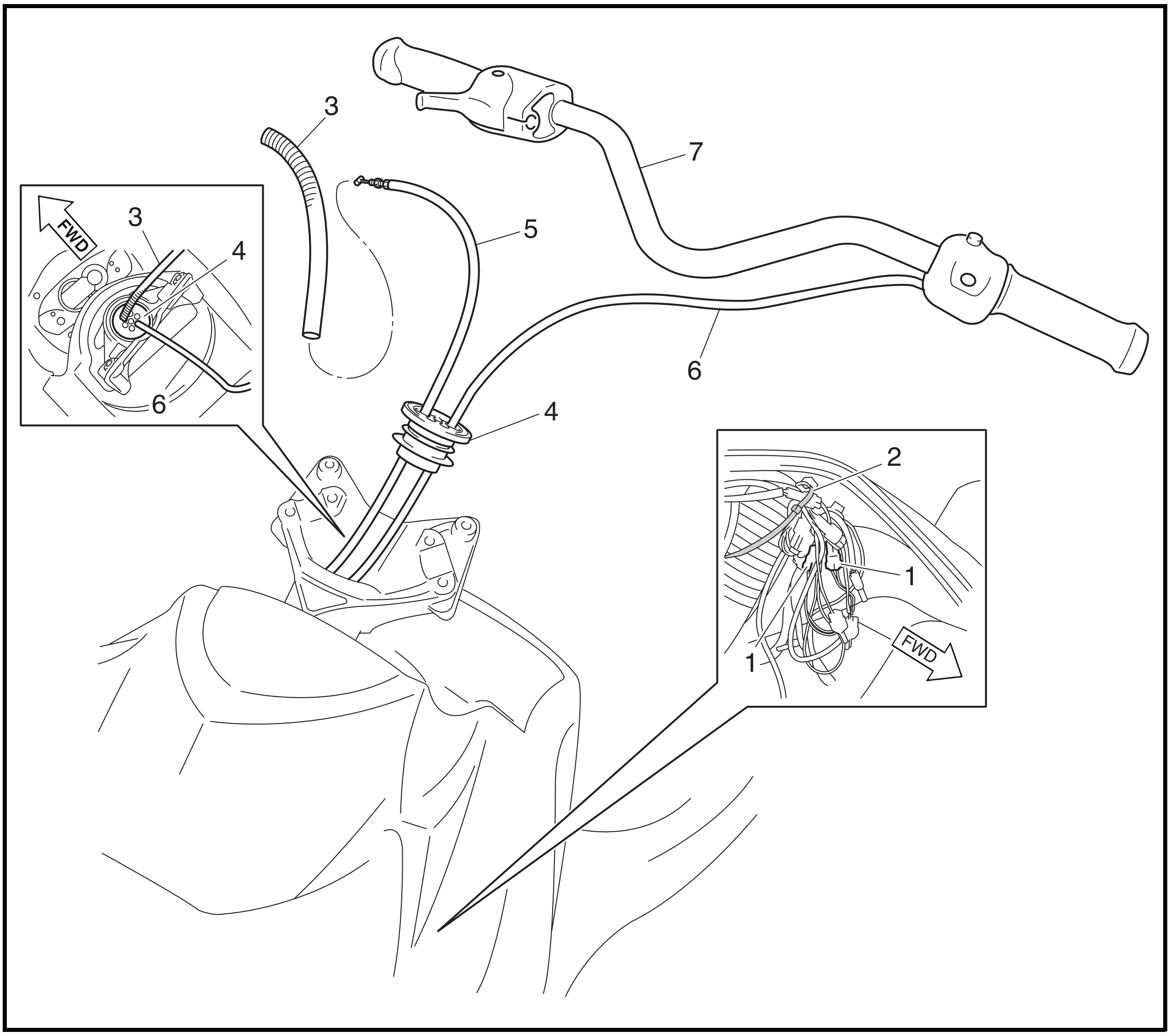
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

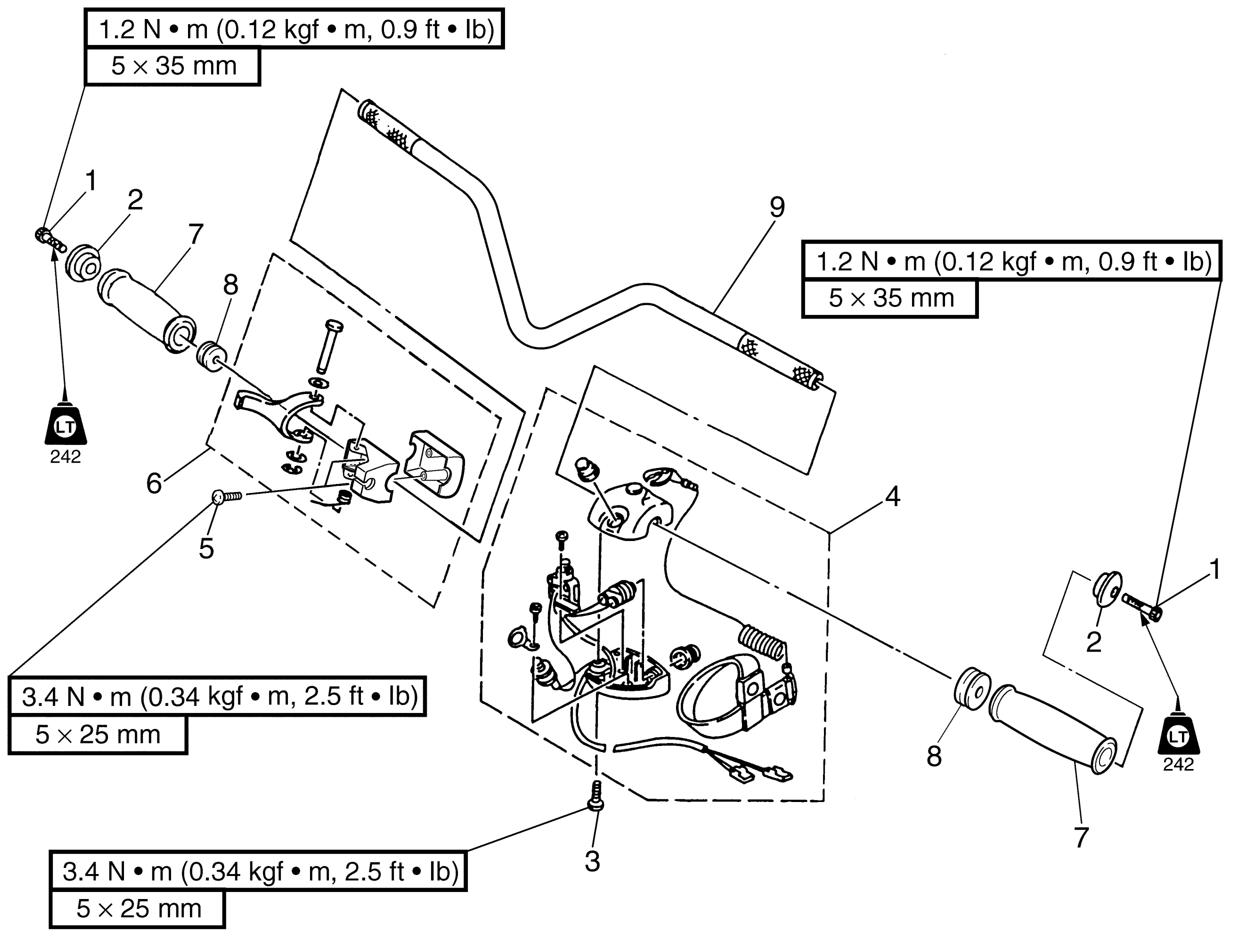
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **HANDLEBAR REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Handlebar switch coupler | 2 | |
| 2 | Plastic tie | 1 | **NOTE:** Fasten the buzzer lead, steering sensor lead, start switch lead, engine shut-off switch lead, and multifunction meter lead with a plastic tie. |
| 3 | Corrugated tube | 1 | |
| 4 | Grommet | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 5 | Throttle cable | 1 | **NOTE:** Pass the throttle cable and wiring harness through the grommet, and then fit the grommet into the steering column. |
| 6 | Handlebar switch lead | 1 | |
| 7 | Handlebar assembly | 1 | |
| | | | Reverse the removal steps for installation. |

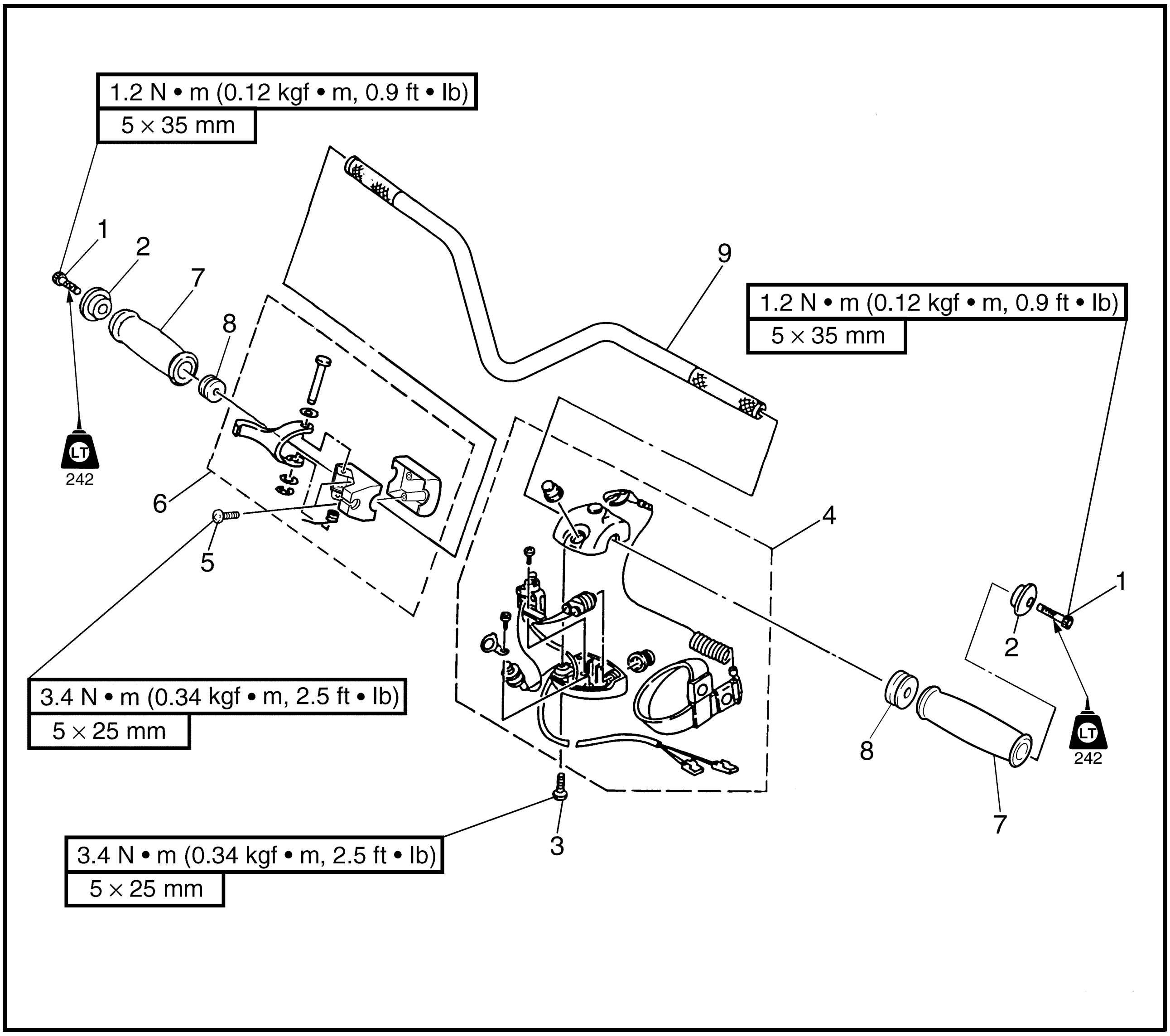
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **HANDLEBAR DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Bolt | 2 | |
| 2 | Grip end | 2 | |
| 3 | Screw | 2 | **NOTE:** Tighten the screw from the engine stop switch side. |
| 4 | Handlebar switch assembly | 1 | |
| 5 | Screw | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 6 | Throttle lever assembly | 1 | |
| 7 | Handlebar grip | 2 | **NOTE:** Apply adhesive to the handlebar and the inner surface of the handlebar grip. |
| 8 | End plate | 2 | |
| 9 | Handlebar | 1 | |
| | | | Reverse the disassembly steps for assembly. |

## SERVICE POINTS

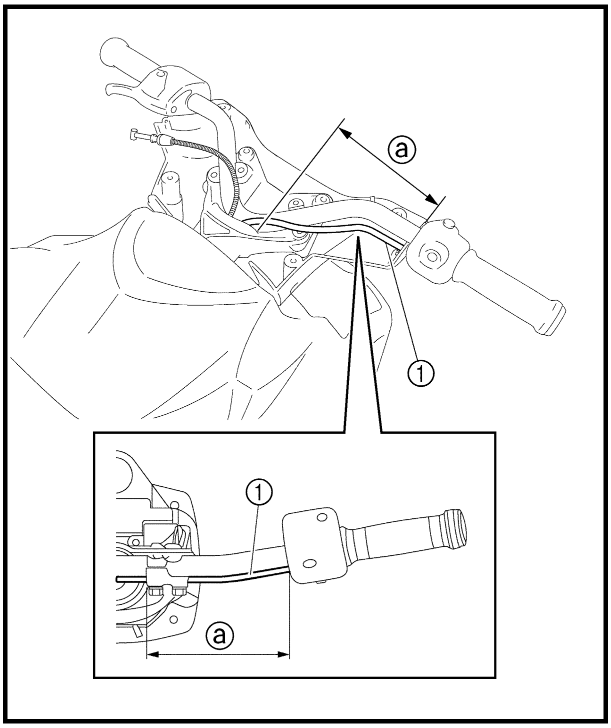
### Handlebar inspection

1. Inspect:
   - Handlebar
     Bends/cracks/damage → Replace.

### Handlebar switch inspection

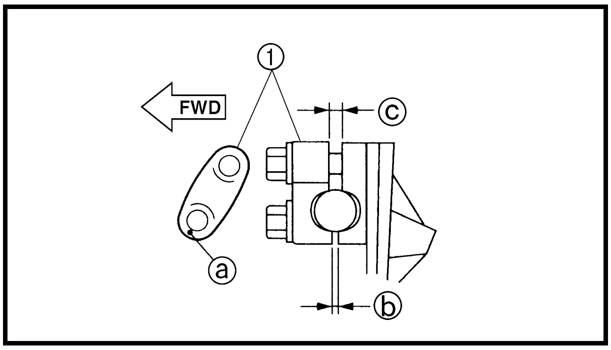
Refer to “STARTING SYSTEM” in Chapter 7.

### Handlebar assembly installation




1. Install:
   - Handlebar switch lead ①

**NOTE:**
Be sure to leave some slack in the handlebar switch lead ① in the area ⓐ shown in the illustration.



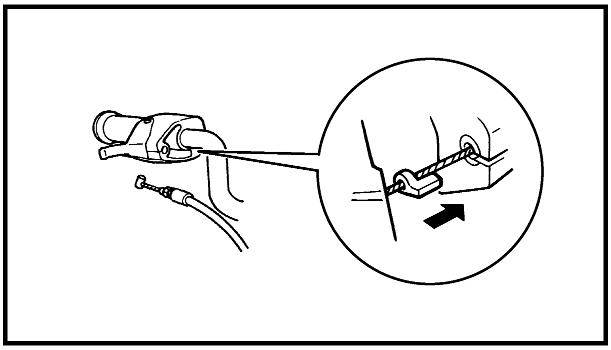

2. Install:
   - Upper handlebar holder ①

**NOTE:**
The upper handlebar holder should be installed with the punch mark ⓐ facing forward.

**CAUTION:**
**Clearance ⓑ should be narrower than clearance ⓒ.**

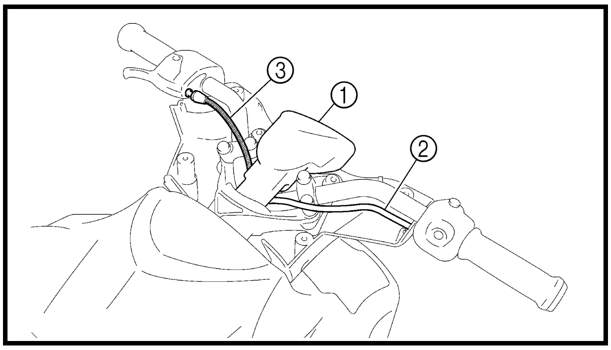
**Handlebar holder bolt:**
**20 N • m (2.0 kgf • m, 14 ft • lb)**
**LOCTITE 572**

**Reference clearance:**
**ⓑ: 1.5 mm (0.06 in)**
**ⓒ: 3.5 mm (0.14 in)**



3. Install:
   - Throttle cable

**NOTE:**
Fit the seal into the groove in the bracket.

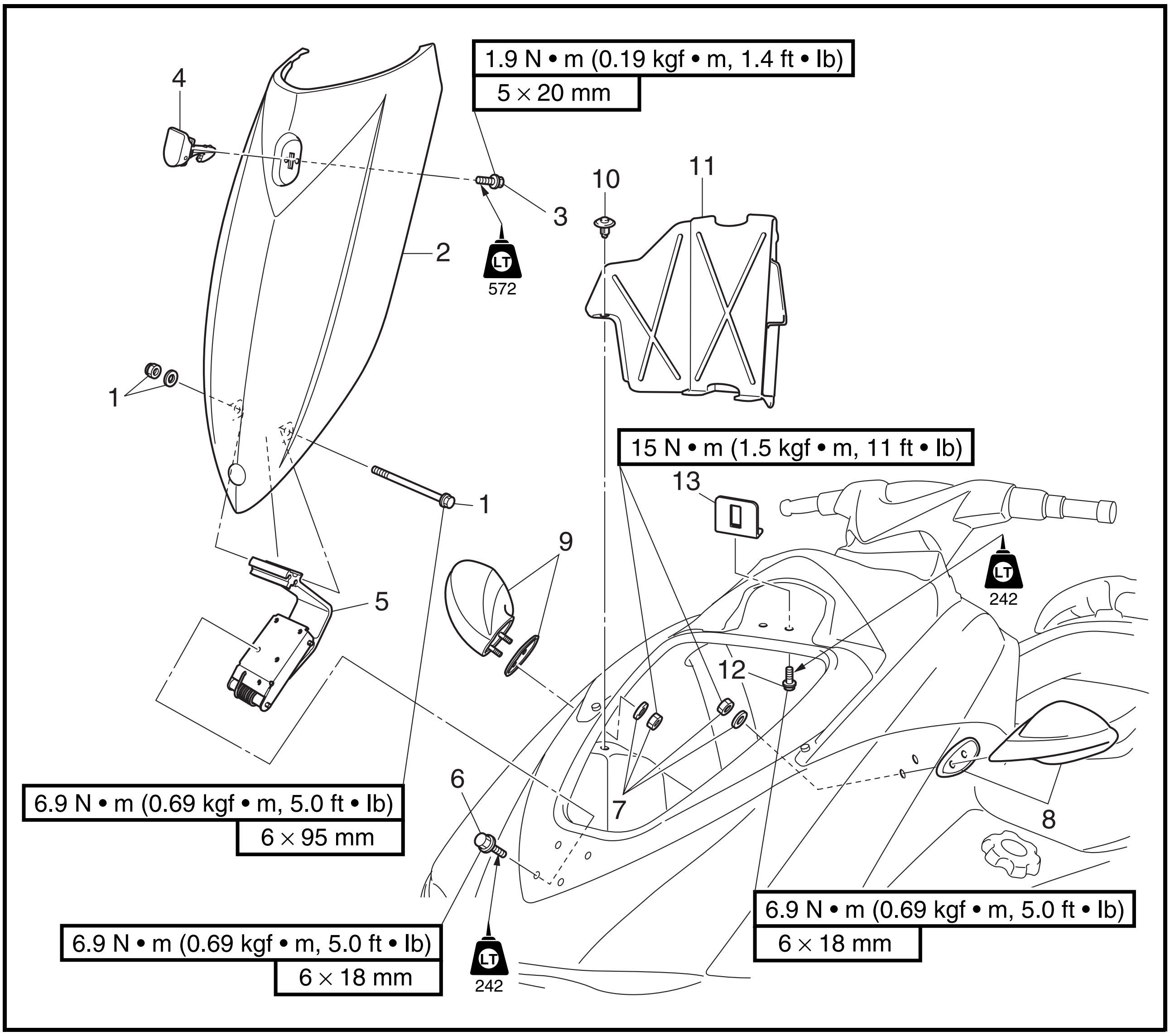



4. Install:
   - Pad ①

**NOTE:**
Make sure that the handlebar switch lead ② and throttle cable ③ are routed behind the pad ① when installing the pad ① onto the steering column.

5. Adjust:
   - Throttle cable free play
     Refer to "CONTROL SYSTEM" in Chapter 3.

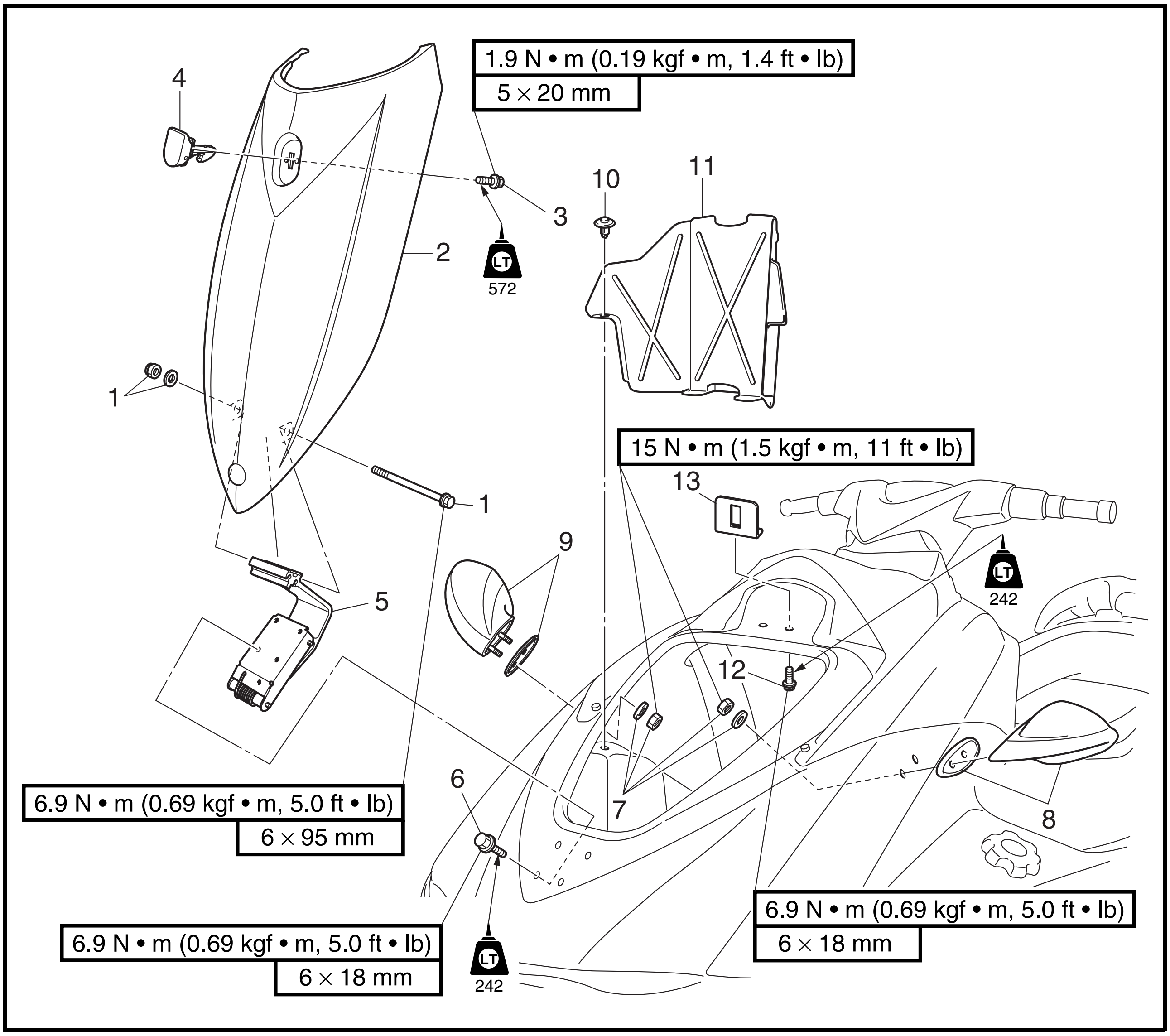
# FRONT HOOD
## EXPLODED DIAGRAM



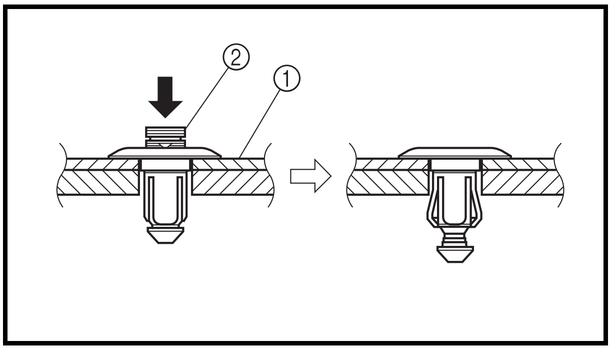

## REMOVAL AND INSTALLATION CHART

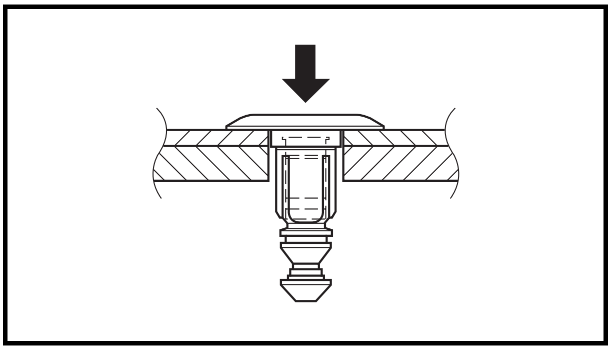
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **FRONT HOOD REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Bolt/washer/nut | 2/2/2 | |
| 2 | Front hood assembly | 1 | |
| 3 | Bolt | 2 | |
| 4 | Hood lock assembly | 1 | |
| 5 | Hinge assembly | 1 | |
| 6 | Bolt | 4 | |
| 7 | Nut/washer | 4/4 | Deluxe model only |
| 8 | Left mirror/seal | 1/1 | Deluxe model only |

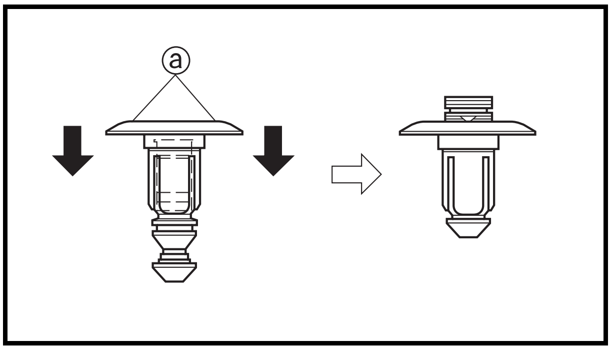
## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 9 | Right mirror/seal | 1/1 | Deluxe model only |
| 10 | Rivet | 4 | |
| 11 | Storage compartment panel | 1 | |
| 12 | Bolt | 2 | |
| 13 | Lid lock hook | 1 | |
| | | | Reverse the removal steps for installation. |






## SERVICE POINTS

### Rivet Installation

1. Install:
   - Rivets

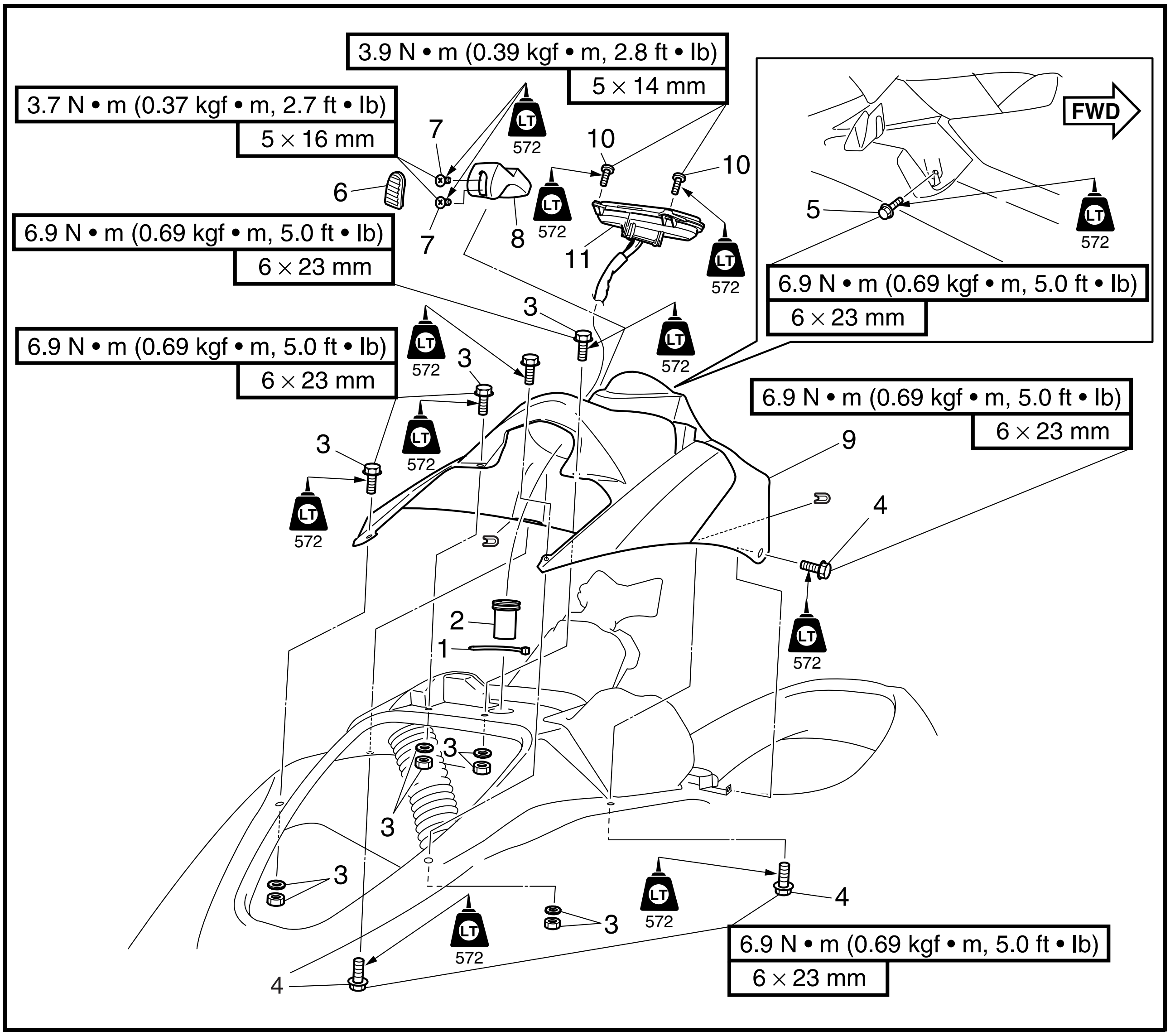
**Installing steps:**

- Insert a rivet completely in the holes in both the storage compartment panel ① and inner hull.
- Push in the rivet pin ② until it clicks and is flush with the top of the rivet.

**NOTE:**

- To remove a rivet, push the rivet pin in until it clicks and is below the top of the rivet.
- Before reinstalling a rivet, hold the rivet flange ⓐ with both hands and push the rivet pin perpendicularly against a hard flat surface until the pin protrudes from the top of the rivet.

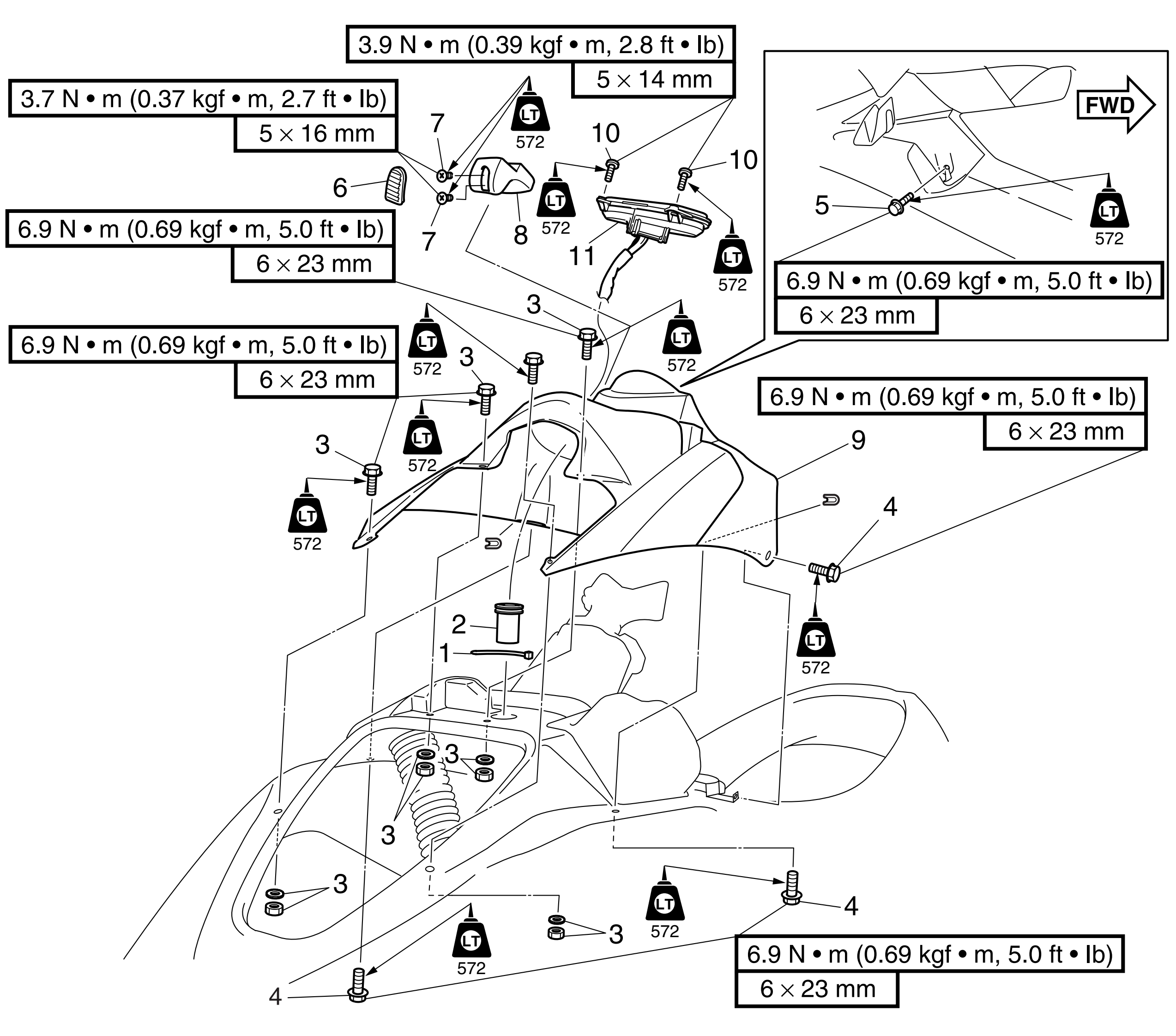
# ENGINE HATCH COVER
## EXPLODED DIAGRAM



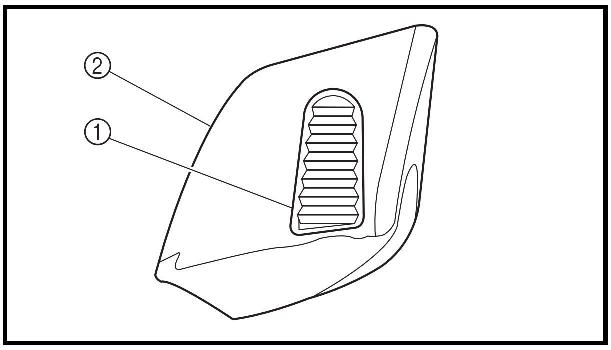

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **ENGINE HATCH COVER REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Band | 1 | |
| 2 | Grommet | 1 | |
| 3 | Bolt/washer/nut | 4/4/4 | |
| 4 | Bolt | 4 | |
| 5 | Bolt | 1 | Deluxe model only |
| 6 | Damper stopper | 1 | Deluxe model only |
| 7 | Screw | 2 | Deluxe model only |

### EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Shift lever handle | 1 | Deluxe model only |
| 9 | Engine hatch cover | 1 | |
| 10 | Bolt | 4 | |
| 11 | Multifunction meter | 1 | |
| | | | Reverse the removal steps for installation. |




## SERVICE POINTS

**Damper stopper inspection (Deluxe model only)**

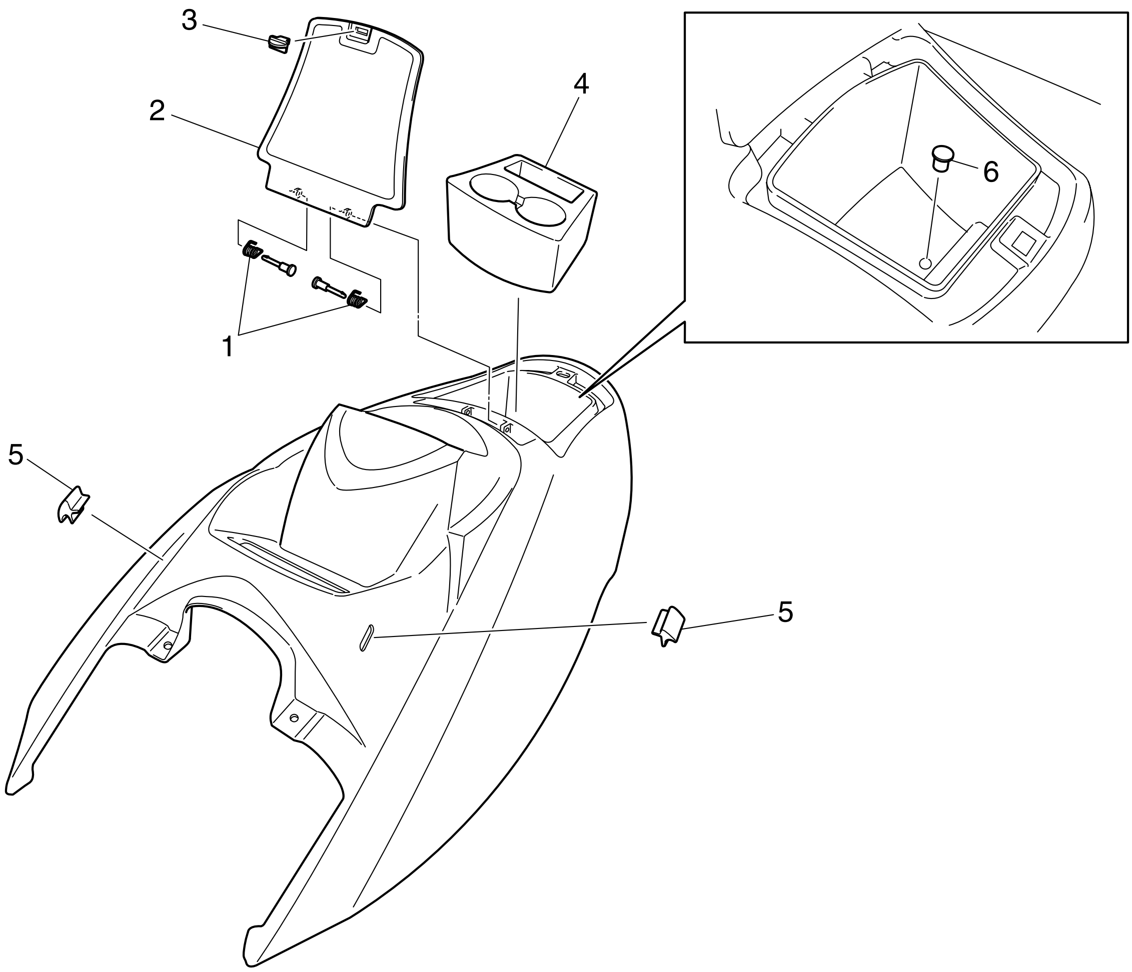
1. Install:
   - Damper stopper ①
   - Shift lever handle ②

**NOTE:**
To install the damper stopper, insert it into the hole in the shift lever handle from the bottom, and then slide it upward.

# ENGINE HATCH COVER

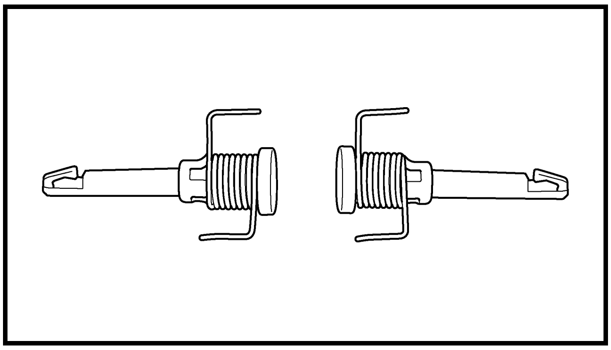


## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **GLOVE COMPARTMENT REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Hinge assembly | 2 | |
| 2 | Lid | 1 | |
| 3 | Latch | 1 | |
| 4 | Cap holder | 1 | |
| 5 | Hood bumper | 2 | |
| 6 | Drain plug | 1 | |
| | | | Reverse the removal steps for installation. |



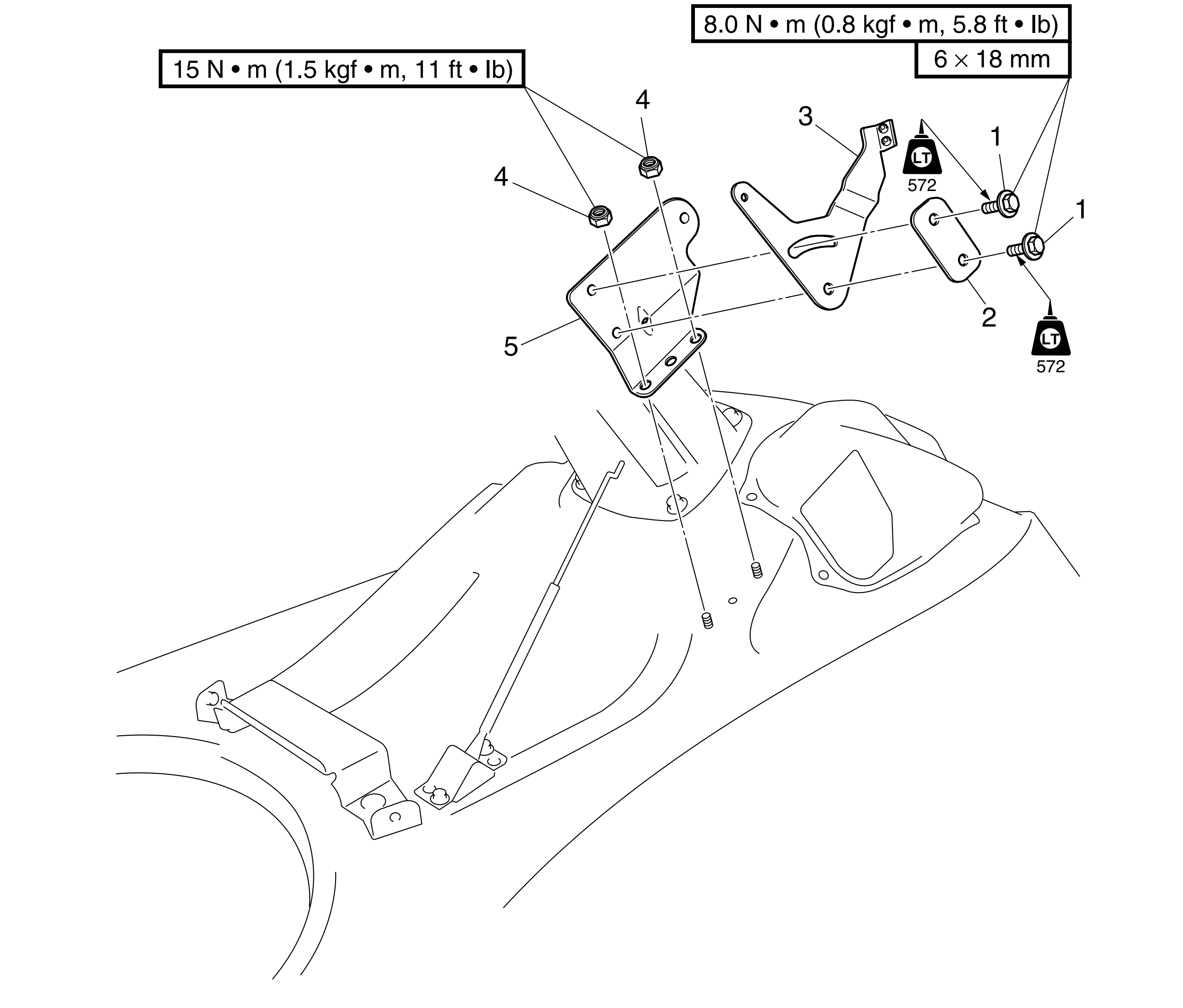
## SERVICE POINTS

### Glove compartment assembly installation

1. Install:
   - Hinge assembly

**NOTE:**
When installing the hinge assembly, make sure that the springs are in the position shown.

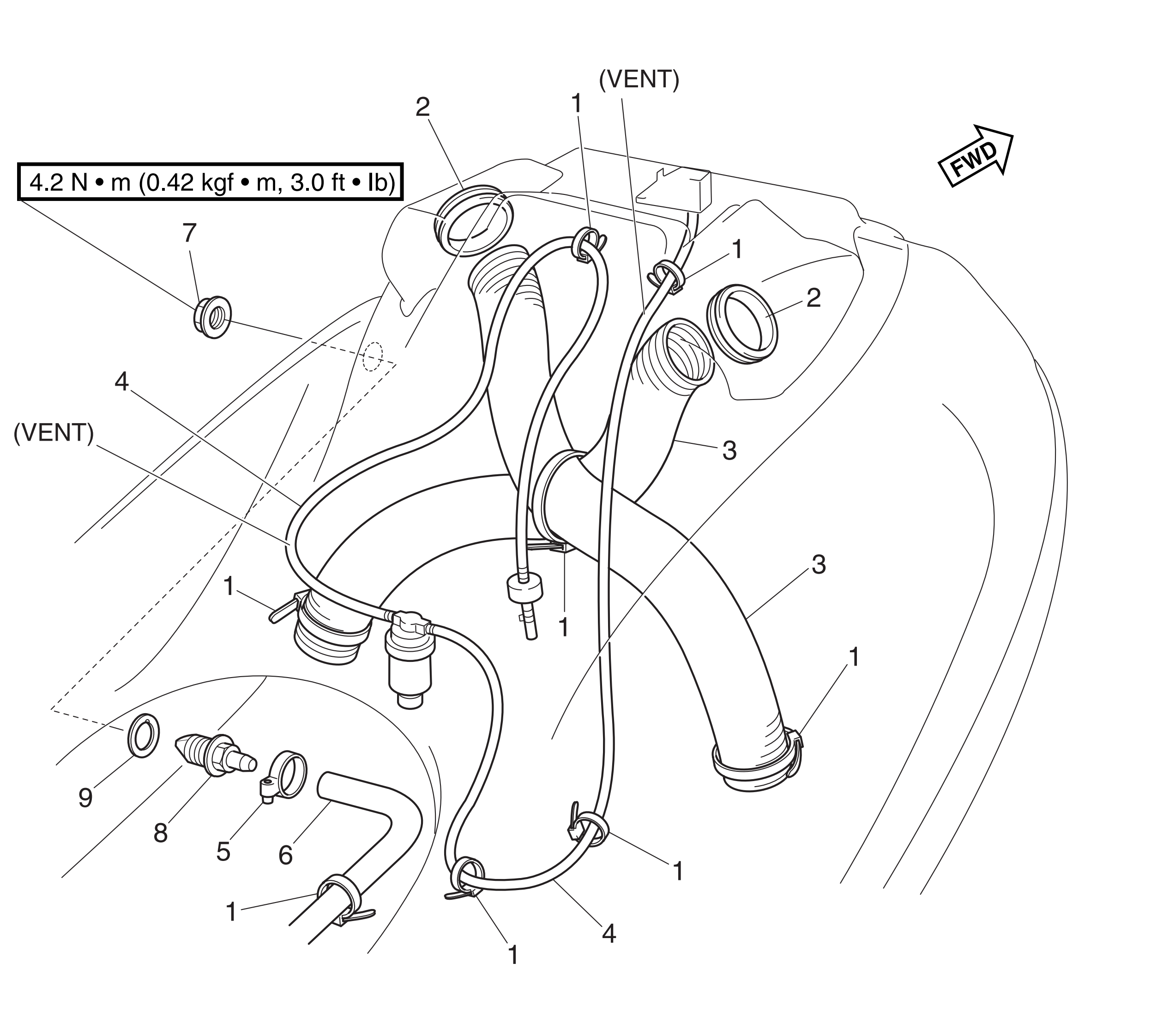
# SHIFT LEVER (DELUXE MODEL ONLY)
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **SHIFT LEVER REMOVAL** | | Follow the left "Step" for removal. |
| | Engine hatch cover | | Refer to "ENGINE HATCH COVER". |
| | Shift cable | | Refer to "REMOTE CONTROL CABLES AND SPEED SENSOR LEAD". |
| 1 | Bolt | 2 | |
| 2 | Detent plate | 1 | |
| 3 | Shift lever | 1 | |
| 4 | Nut | 2 | |
| 5 | Bracket | 1 | |
| | | | Reverse the removal steps for installation. |

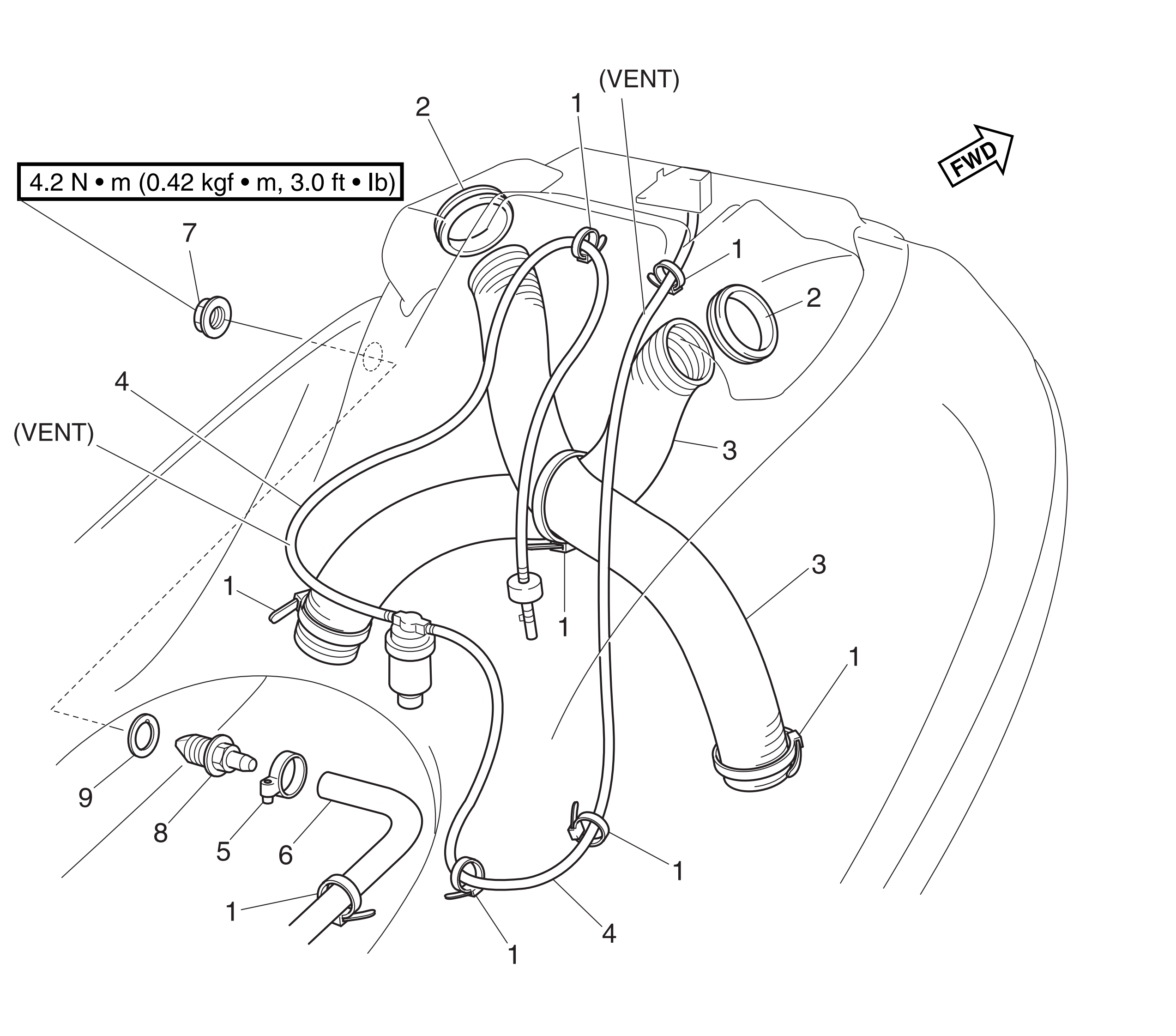
# HOSES
## EXPLODED DIAGRAM



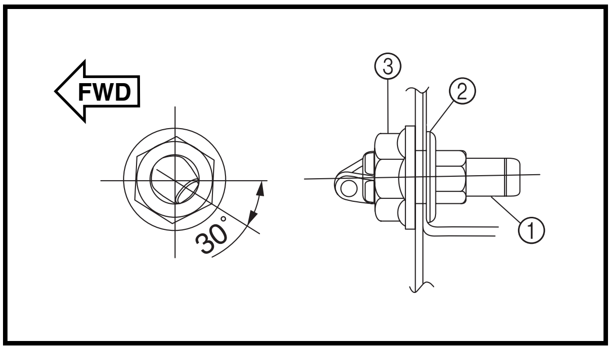

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **HOSES REMOVAL** | | Follow the left "Step" for removal. |
| | Fuel tank | | Refer to "FUEL TANK AND FUEL PUMP MODULE" in Chapter 4. |
| | Accelerator position sensor | | Refer to "Throttle cable inspection and adjustment" in Chapter 3. **NOTE:** When removing the ventilation hose and fuel tank breather hose, it is not necessary to remove the fuel tank. |
| 1 | Band | 8 | |
| 2 | Grommet | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 3 | Ventilation hose | 2 | |
| 4 | Fuel tank breather hose | 2 | |
| 5 | Clamp | 1 | |
| 6 | Cooling water hose | 1 | |
| 7 | Nut | 1 | |
| 8 | Cooling water pilot outlet | 1 | |
| 9 | Seal | 1 | |
| | | | Reverse the removal steps for installation. |



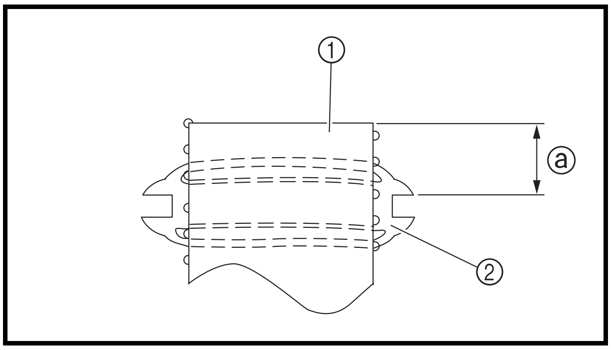

## SERVICE POINTS

### Cooling water pilot outlet installation

1. Install:
   - Cooling water pilot outlet ①
   - Seal ②
   - Nut ③

**NOTE:**

- When installing the cooling water pilot outlet, face the discharge hole toward the stern and downward at a 30° angle from the horizontal line as shown in the illustration.
- Tighten the nut while holding the cooling water pilot outlet in place.



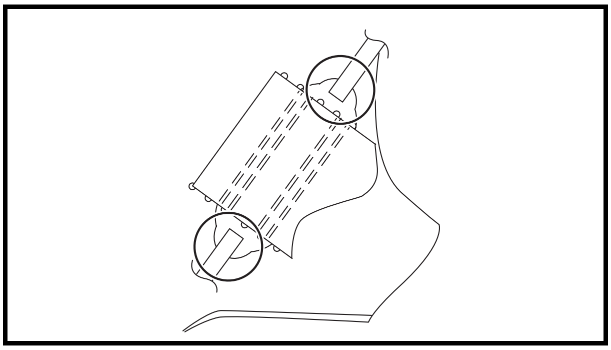

### Grommet installation

1. Install:
   - Ventilation hose ①
   - Grommet ②

**NOTE:**

Install the grommet on the ventilation hose, making sure that the end of the hose protrudes the specified length ⓐ from the groove around the outside of the grommet as shown in the illustration.

**Specified length ⓐ:**
**30–40 mm (1.18–1.57 in)**



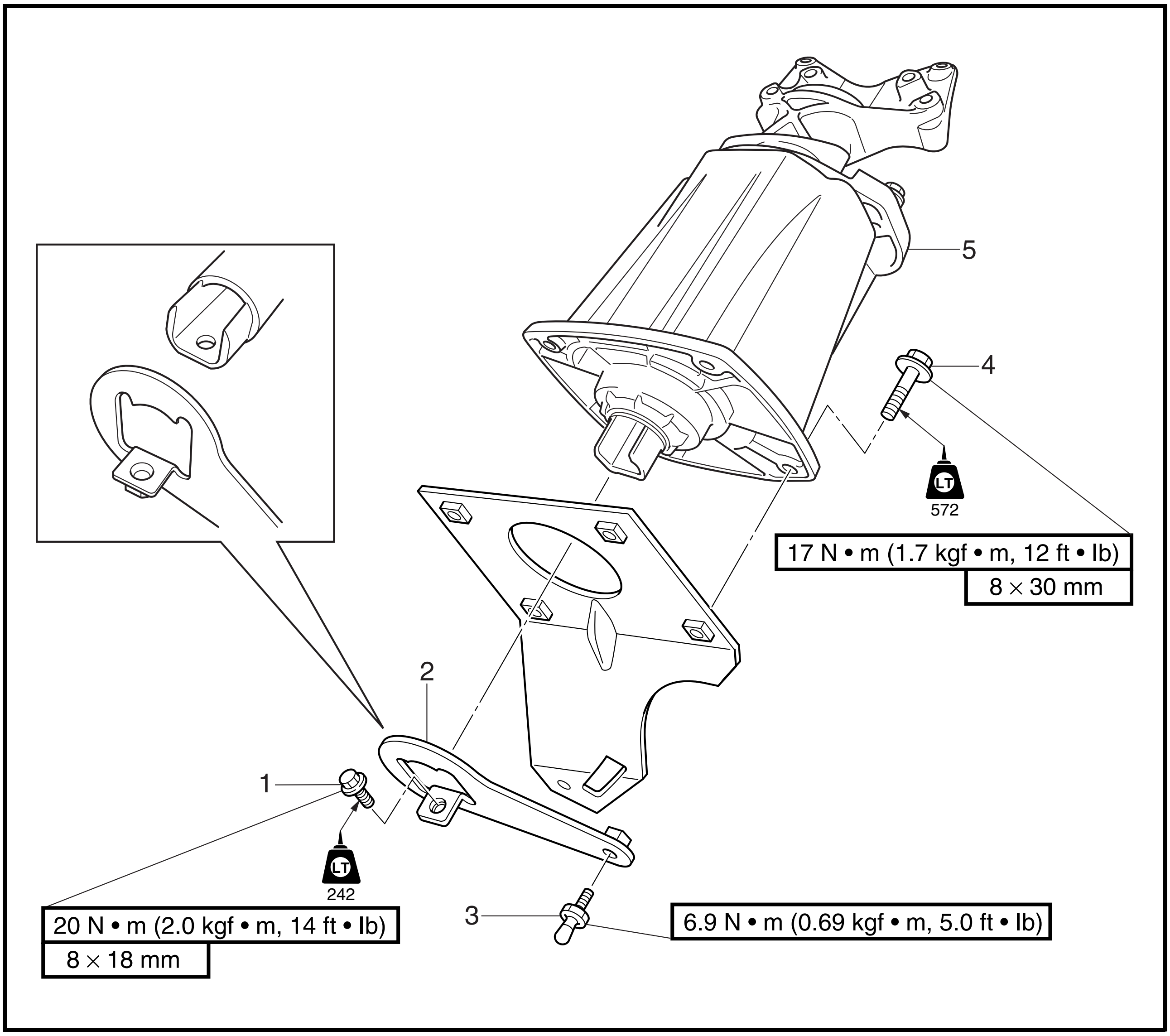
### Ventilation hose assembly installation

1. Install:
   - Ventilation hose assembly

**NOTE:**

When installing the ventilation hose assembly, make sure that the grommet is properly seated in the hole in the inner hull as shown in the illustration.

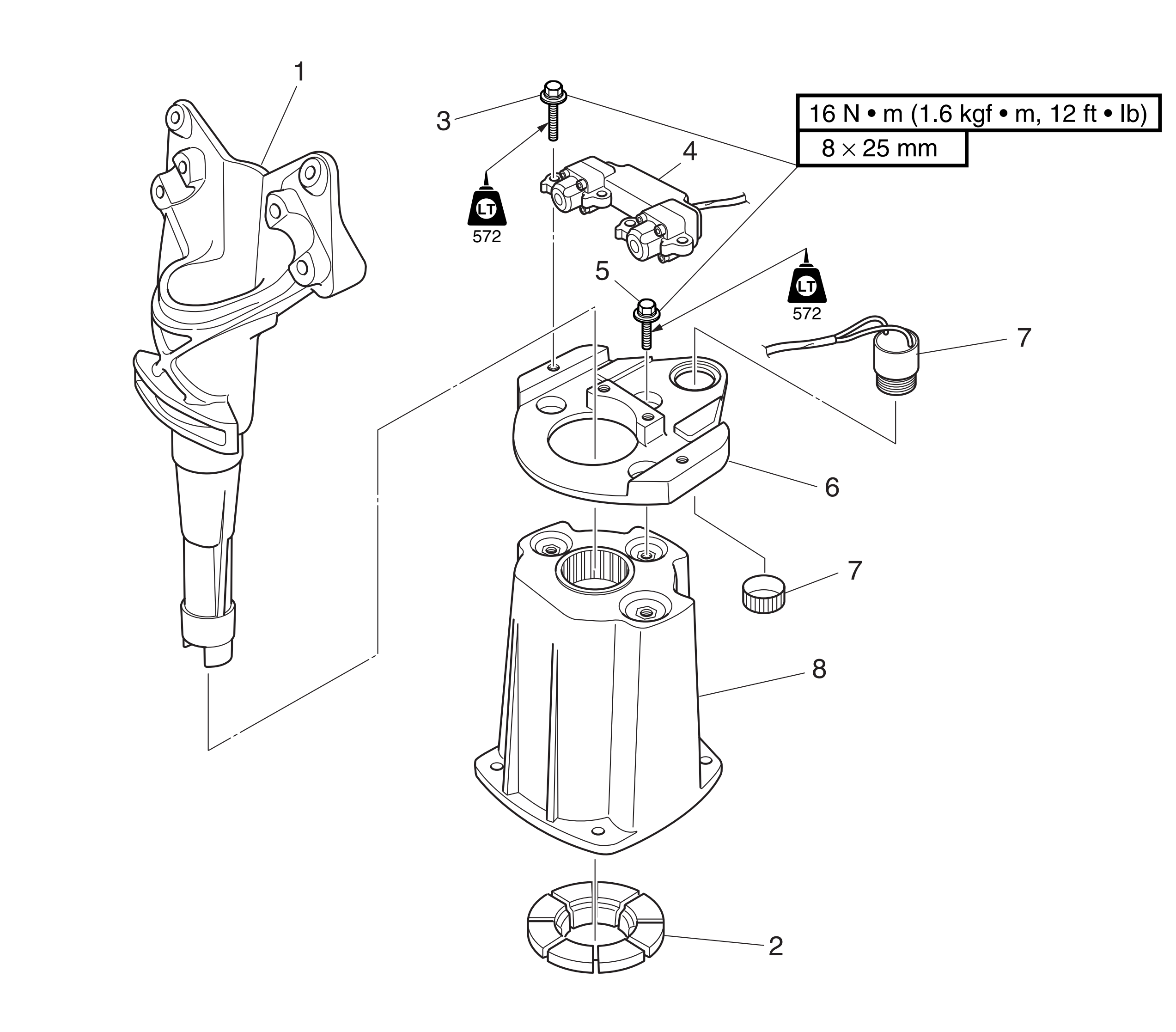
# STEERING COLUMN
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

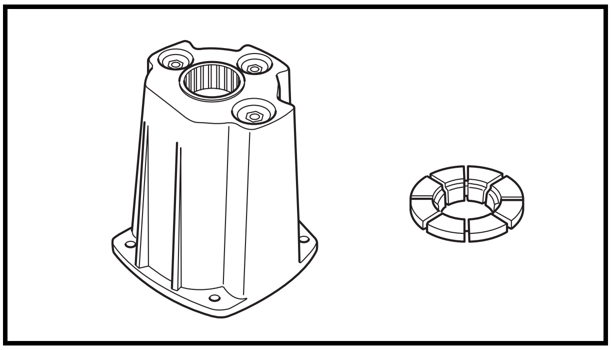
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **STEERING COLUMN REMOVAL** | | Follow the left "Step" for removal. |
| | Engine hatch cover | | Refer to "ENGINE HATCH COVER". |
| | Steering cable end | | Refer to "REMOTE CONTROL CABLES AND SPEED SENSOR LEAD". |
| 1 | Bolt | 1 | |
| 2 | Steering arm | 1 | |
| 3 | Joint ball | 1 | |
| 4 | Bolt | 4 | |
| 5 | Steering column assembly | 1 | |
| | | | Reverse the removal steps for installation. |

## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q’ty | Service points |
|---|---|---|---|
| | **STEERING COLUMN DISASSEMBLY** | | Follow the left “Step” for disassembly. |
| 1 | Steering column | 1 | |
| 2 | Seal rubber | 1 | |
| 3 | Bolt | 4 | |
| 4 | Steering sensor | 1 | |
| 5 | Bolt | 3 | |
| 6 | Spacer | 1 | |
| 7 | Buzzer | 1 | |
| 8 | Steering housing assembly | 1 | |
| | | | Reverse the disassembly steps for assembly. |



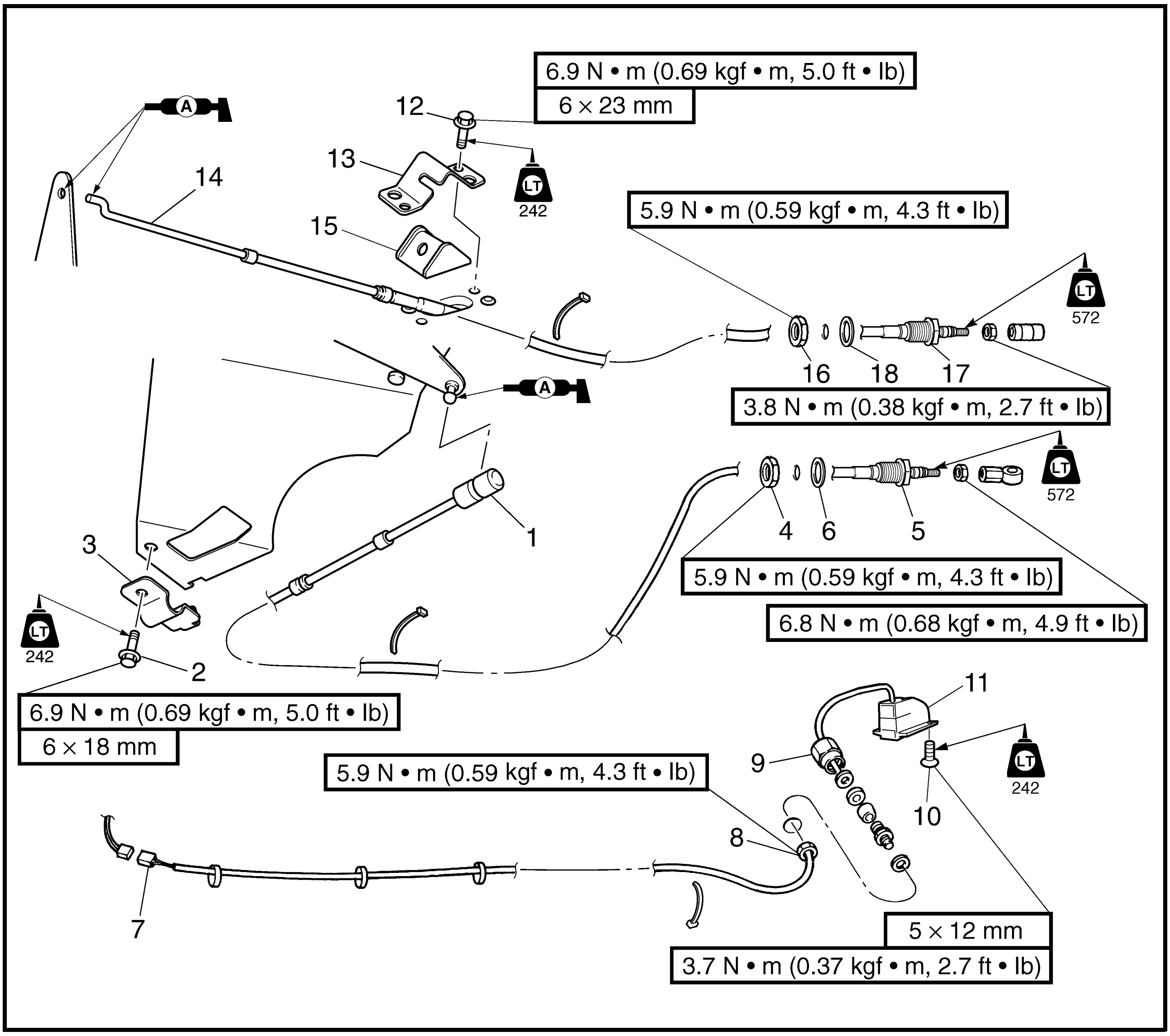
## SERVICE POINTS

### Steering column inspection

1. Inspect:
   - Seal rubber
   - Steering housing assembly
     Cracks/damage/wear → Replace the steering column.

# REMOTE CONTROL CABLES AND SPEED SENSOR LEAD

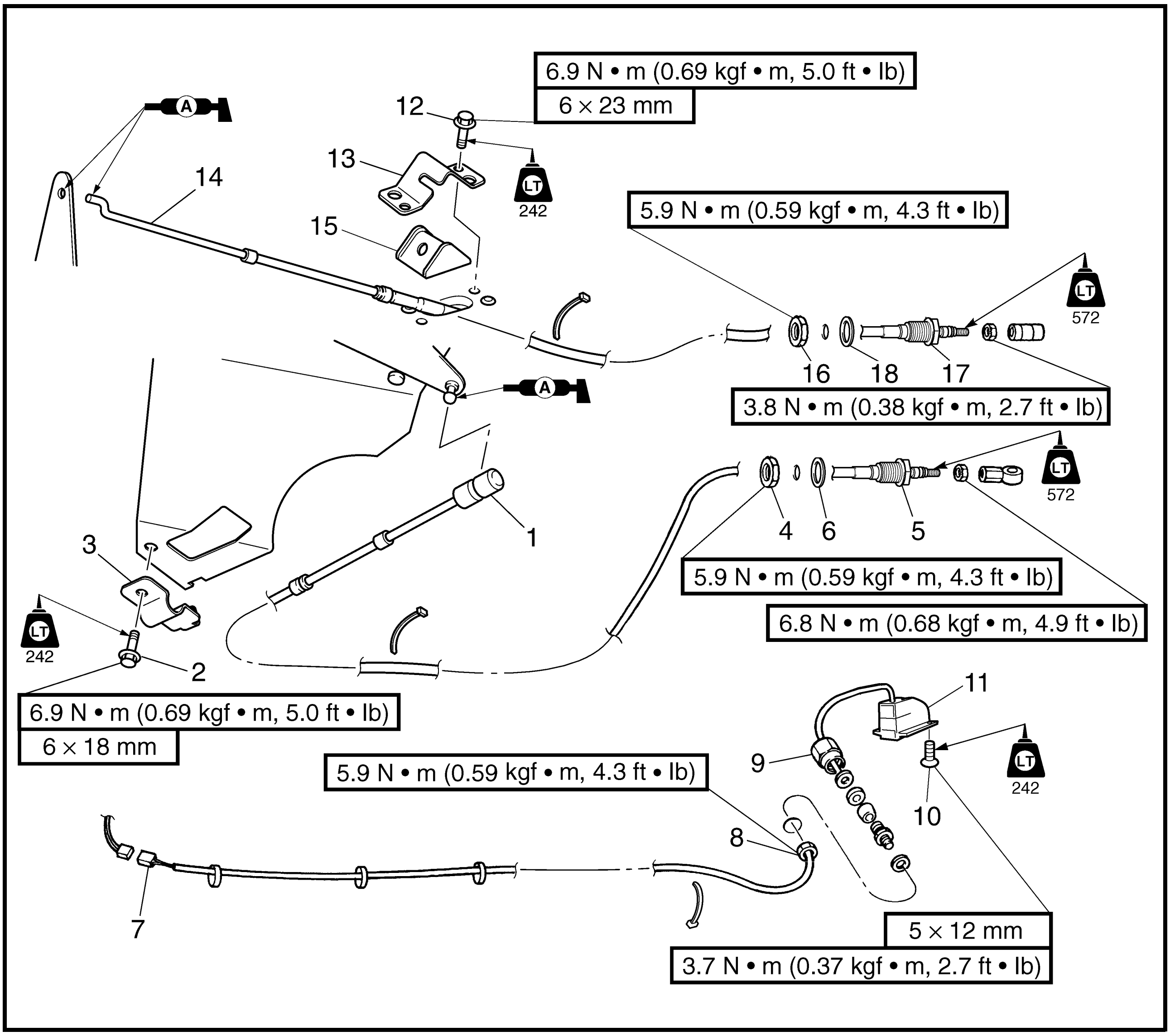
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

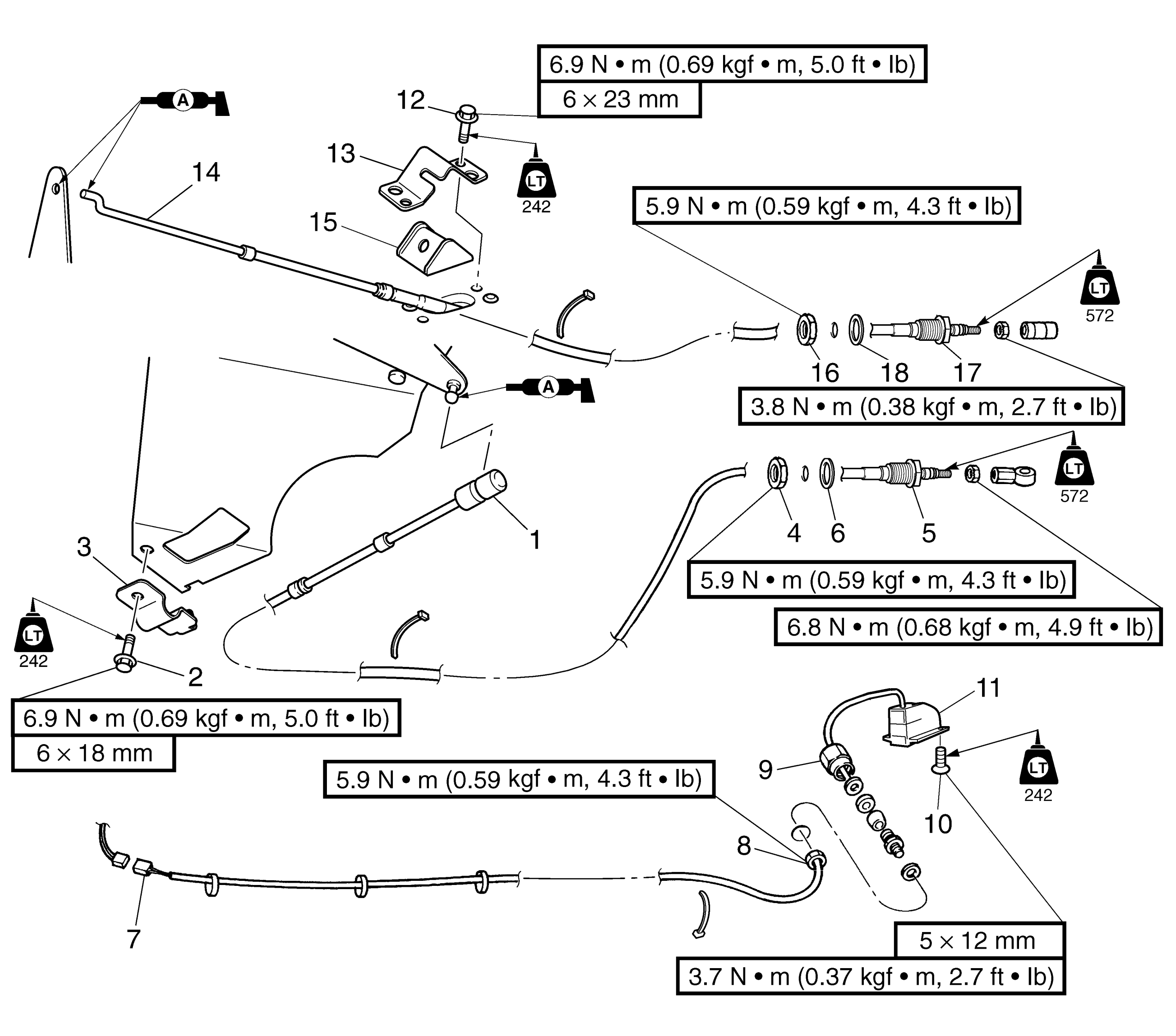
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **REMOTE CONTROL CABLES AND SPEED SENSOR LEAD REMOVAL** | | Follow the left "Step" for removal. |
| | Service lid 1 | | Refer to "FRONT HOOD". |
| | Seat assembly | | Refer to "SEAT AND HAND GRIP". |
| | Engine hatch cover | | Refer to "ENGINE HATCH COVER". |
| | Shift lever | | Refer to "SHIFT LEVER (DELUXE MODEL ONLY)". |
| 1 | Steering cable end | 1 | |
| 2 | Bolt | 1 | |
| 3 | Bracket | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 4 | Nut | 1 | |
| 5 | Steering cable | 1 | |
| 6 | Seal | 1 | |
| 7 | Speed sensor coupler | 1 | |
| 8 | Nut | 1 | |
| 9 | Cap | 1 | |
| 10 | Screw | 4 | |
| 11 | Speed sensor | 1 | |
| 12 | Bolt | 2 | Deluxe model only |
| 13 | Shift cable holder | 1 | Deluxe model only |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 14 | Shift cable end | 1 | Deluxe model only |
| 15 | Grommet | 1 | Deluxe model only |
| 16 | Nut | 1 | Deluxe model only |
| 17 | Shift cable | 1 | Deluxe model only |
| 18 | Seal | 1 | Deluxe model only |
| | | | Reverse the removal steps for installation. |

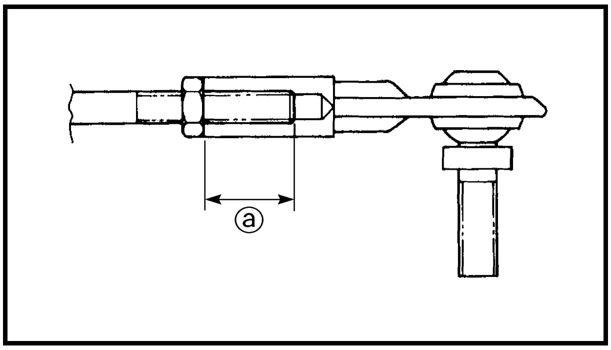
## SERVICE POINTS

**⚠ WARNING**

**When routing the cables, do not grasp the cable by the outer crimped sheath or steel end. This could deform or loosen the cable end due to extreme angles and or pressure. Always hold the cables by the outer cover below the crimp.**
**If a cable becomes damaged replace it. Never attempt to repair a damaged cable.**

### Remote control cables inspection

1. Inspect:
   - Steering cable
   - Shift cable (Deluxe model only)
     Frays/kinks/rough movement → Replace.



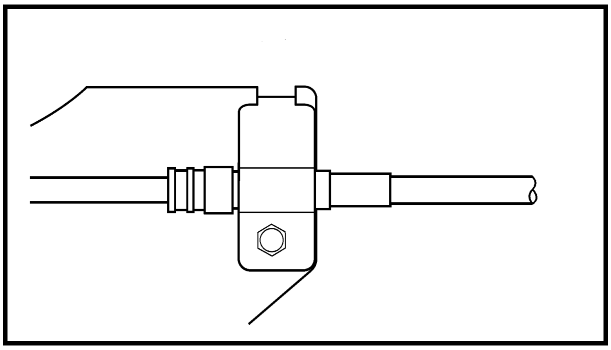

### Steering cable (jet pump end) installation

1. Install:
   - Steering cable

**Steering cable set length ⓐ (jet pump end):**
**14.5 mm (0.57 in)**

**⚠ WARNING**

**The steering cable must be screwed in at least 8 mm (0.31 in).**

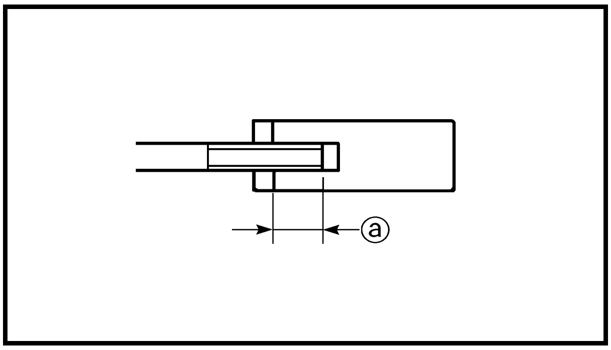


### Steering cable stopper installation

1. Install:
   - Steering cable stopper

**⚠ WARNING**

**Be sure to the steering cable stopper into the groove in the outer cable as shown in the illustration.**



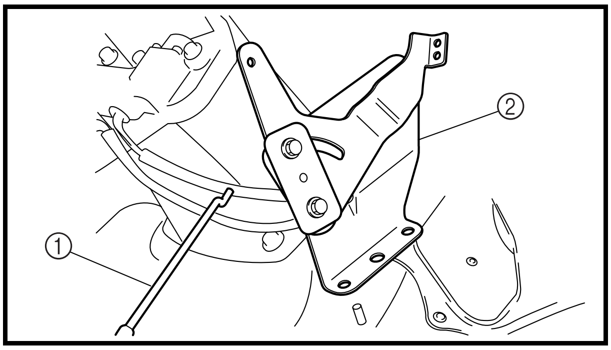

**Shift cable (jet pump end) installation (Deluxe model only)**

1. Install:
   - Shift cable (jet pump end)

**Shift cable set length ⓐ (jet pump end):**
**13.6 mm (0.54 in)**

**⚠ WARNING**

**The shift cable must be screwed in more than 8 mm (0.31 in).**




**Shift cable (shift lever end) installation (Deluxe model only)**

1. Install:
   - Shift cable (shift lever end)

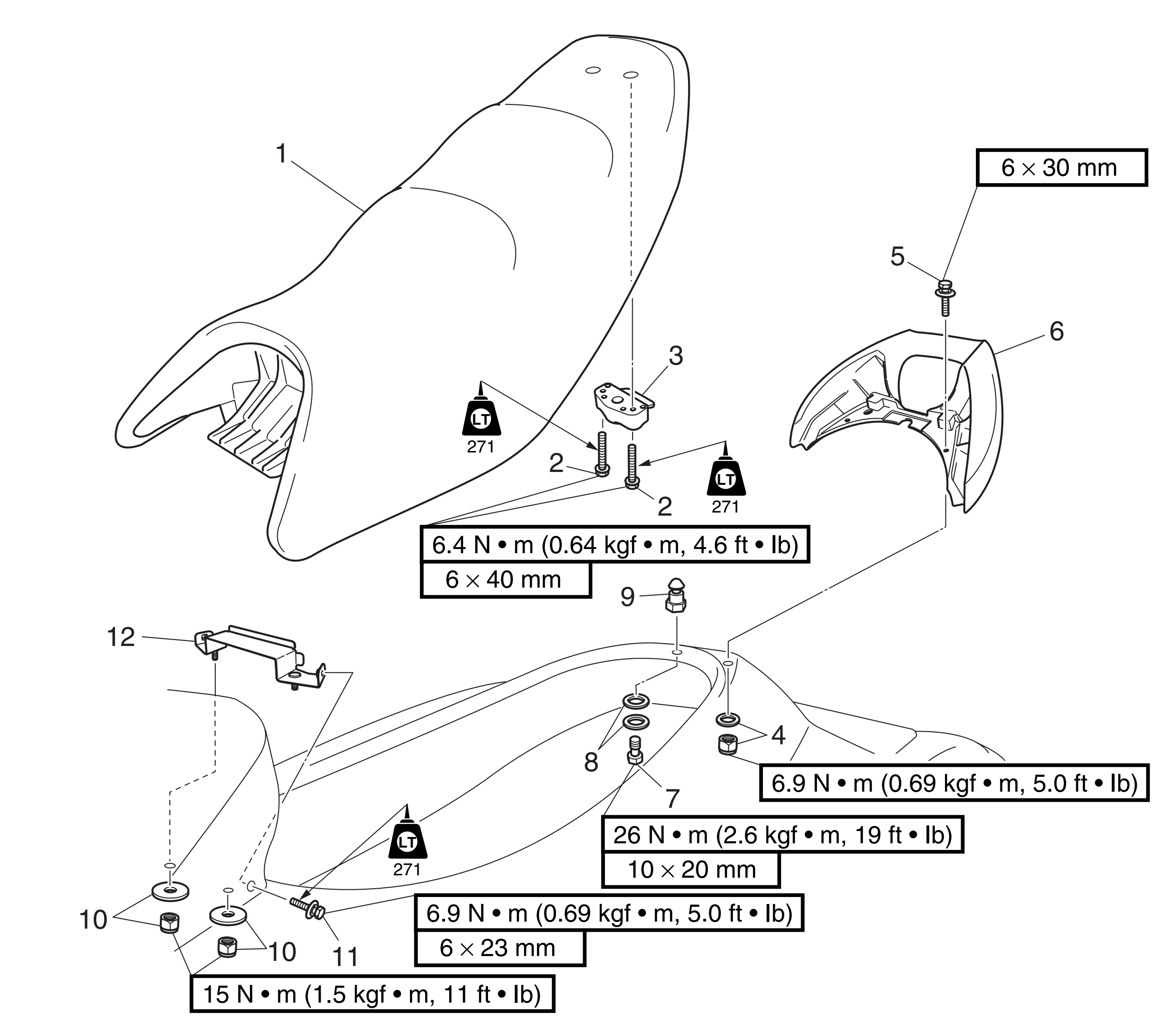
**NOTE:**

Install the shift cable ① before securing the shift lever assembly ② to the deck.

**Remote control cables adjustment**

Refer to “CONTROL SYSTEM” in Chapter 3.

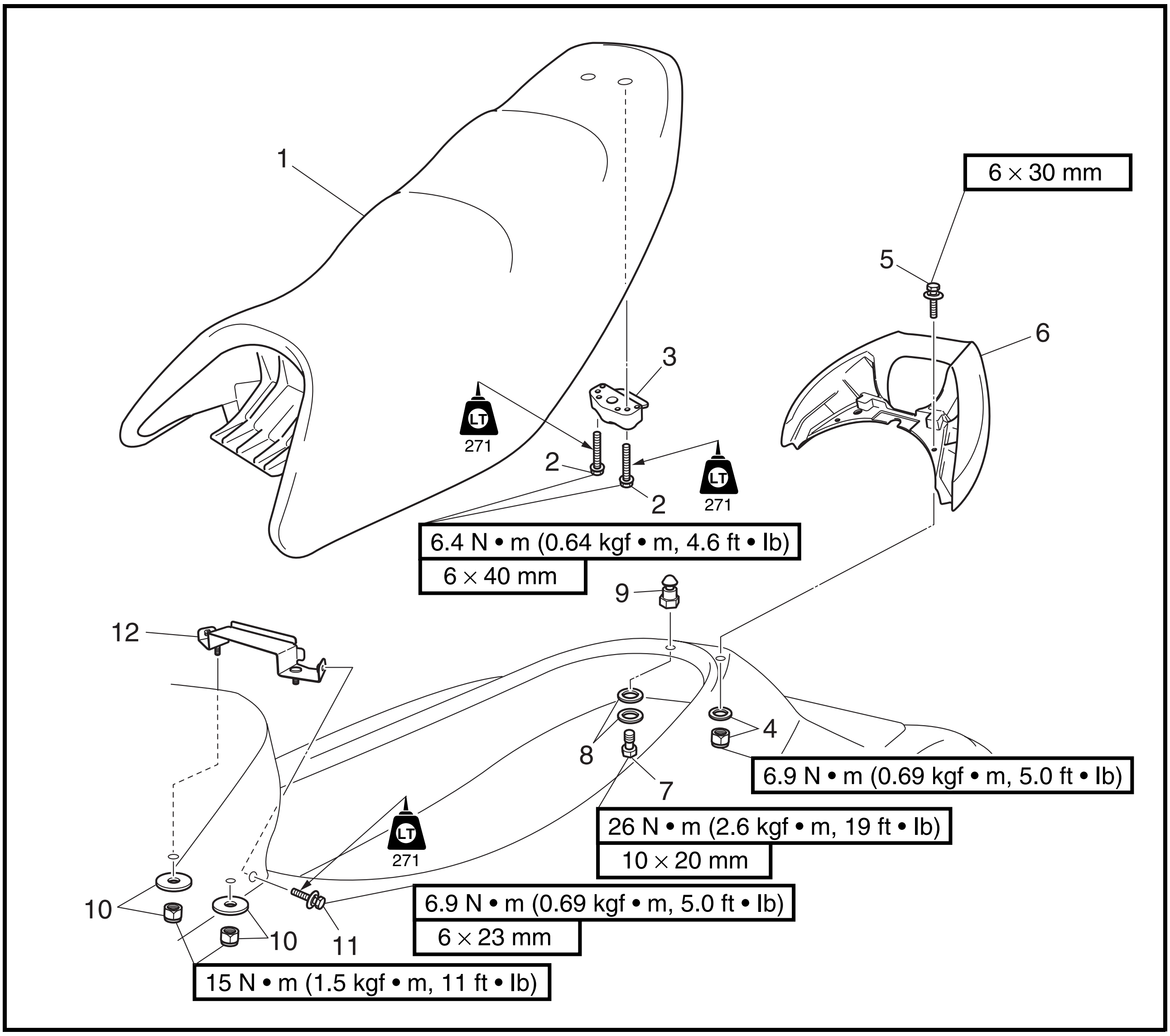
# SEAT AND HAND GRIP
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **SEAT AND HAND GRIP REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Seat assembly | 1 | |
| 2 | Bolt | 2 | |
| 3 | Seat lock assembly | 1 | |
| 4 | Nut/washer | 4/4 | |
| 5 | Bolt | 4 | |
| 6 | Hand grip | 1 | |
| 7 | Bolt | 1 | |

## EXPLODED DIAGRAM



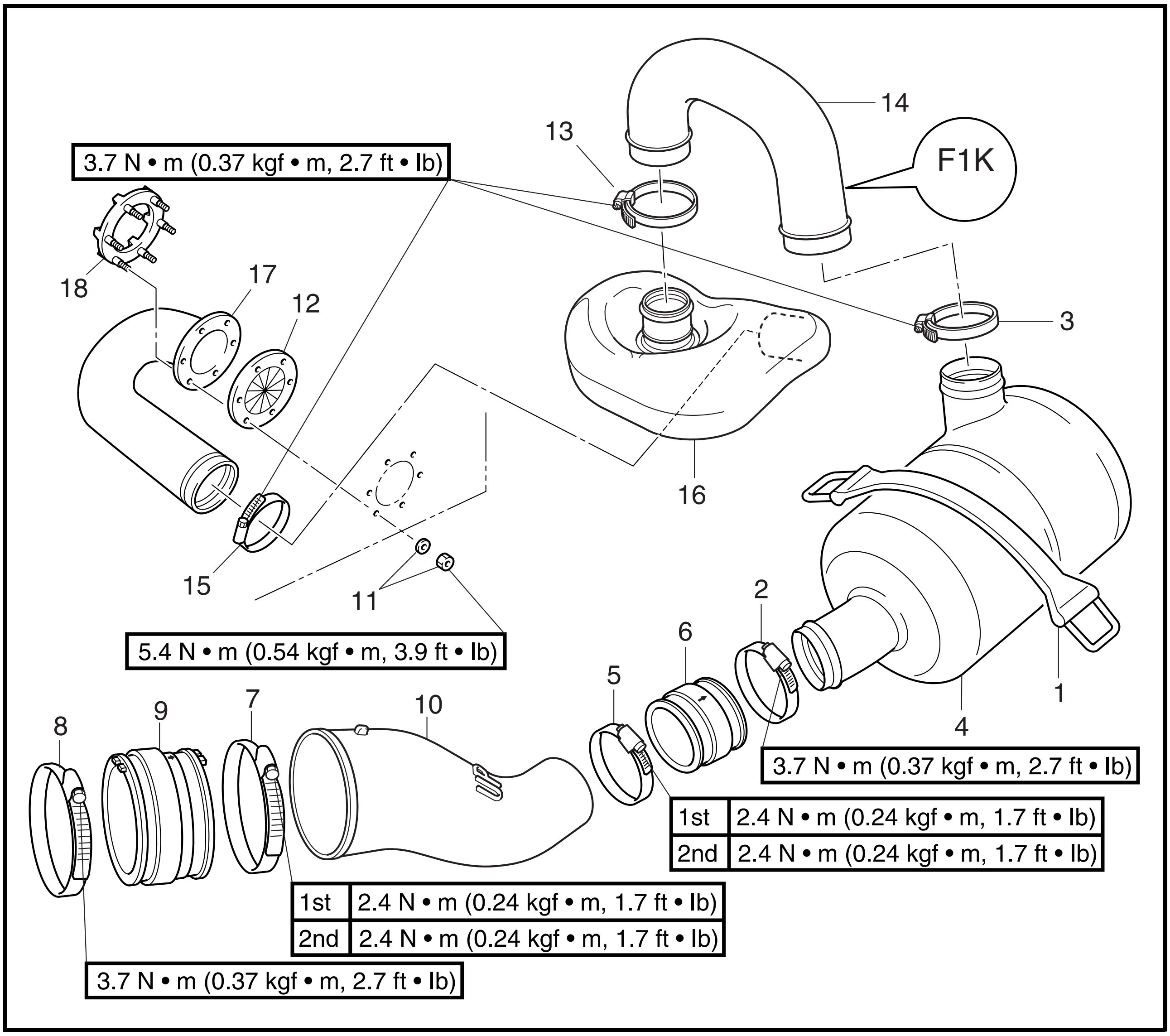

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Spring washer/washer | 1/1 | |
| 9 | Projection | 1 | |
| 10 | Nut/washer | 2/2 | |
| 11 | Bolt | 2 | |
| 12 | Seat bracket | 1 | |
| | | | Reverse the removal steps for installation. |

## SERVICE POINTS

### Seat lock assembly inspection

1. Inspect:
   - Seat lock assembly
     Damage/wear → Replace.

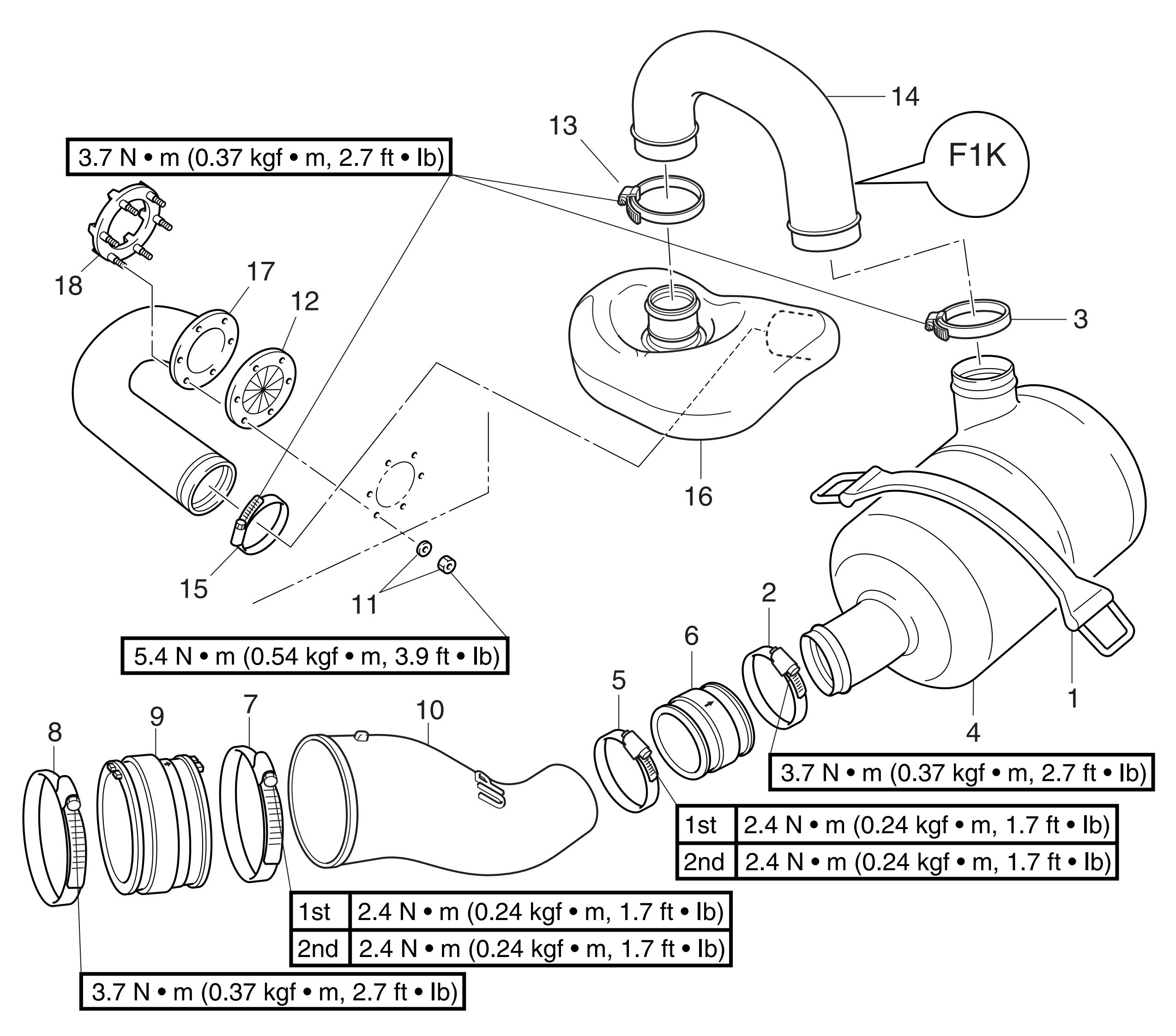
# EXHAUST SYSTEM
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

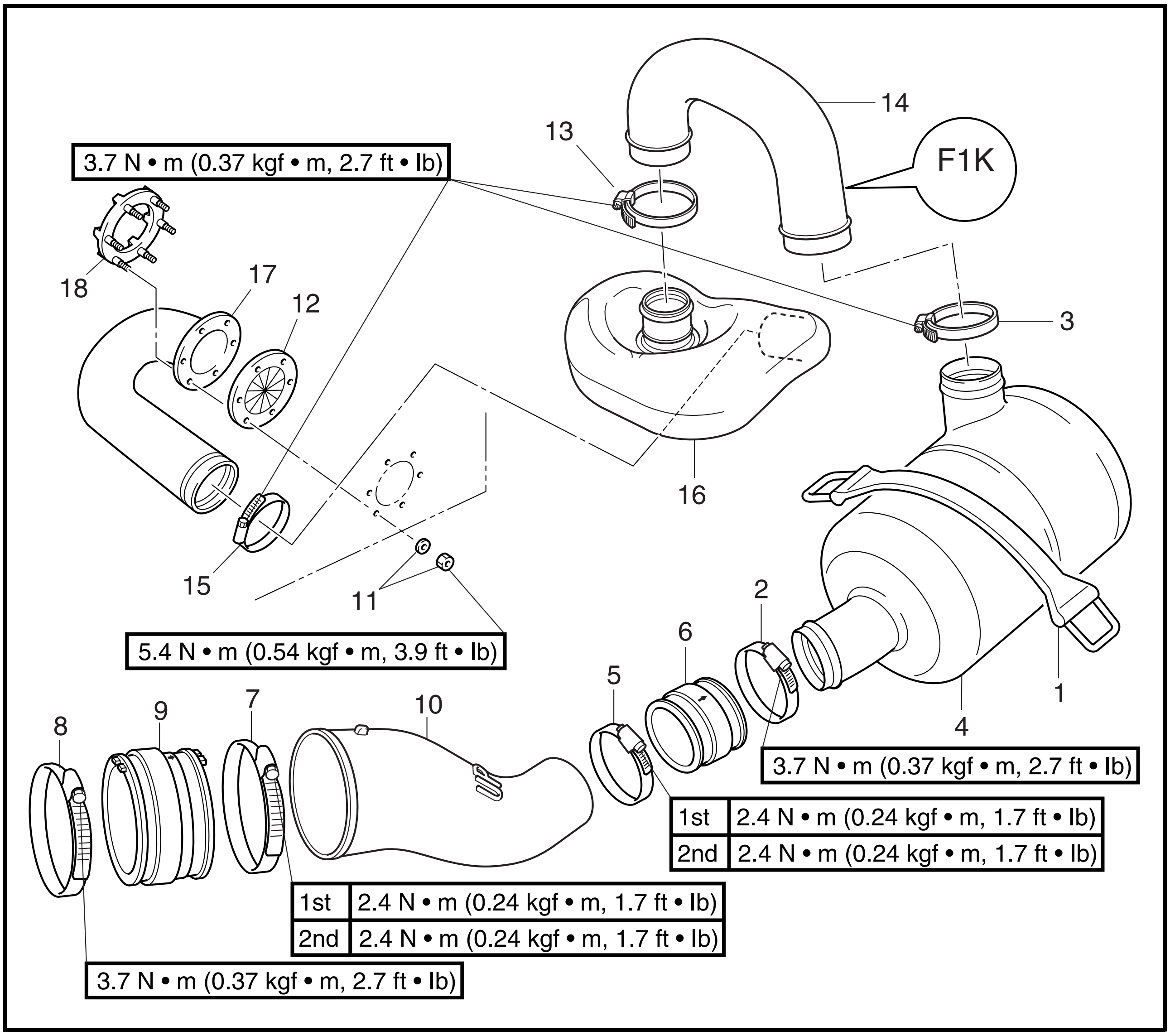
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **EXHAUST SYSTEM REMOVAL** | | Follow the left "Step" for removal. |
| | Deck beam | | Refer to "SEAT AND HAND GRIP". |
| | Jet pump unit assembly | | Refer to "JET PUMP UNIT" in Chapter 6.<br>**NOTE:**<br>When removing the water lock and exhaust joint, it is not necessary to remove the jet pump unit. |
| 1 | Band | 1 | |
| 2 | Joint clamp 1 | 1 | |
| 3 | Hose clamp 1 | 1 | |
| 4 | Water lock | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 5 | Joint clamp 2 | 1 | |
| 6 | Joint | 1 | |
| 7 | Joint clamp 3 | 1 | |
| 8 | Joint clamp 4 | 1 | |
| 9 | Joint | 1 | |
| 10 | Exhaust joint | 1 | |
| 11 | Nut/washer | 6/6 | |
| 12 | Exhaust valve | 1 | |
| 13 | Hose clamp 1 | 1 | |
| 14 | Rubber hose | 1 | |

## EXPLODED DIAGRAM

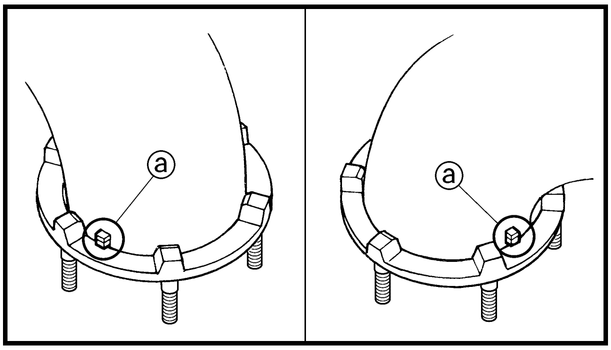



| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 15 | Hose clamp 2 | 1 | |
| 16 | Water tank | 1 | |
| 17 | Rubber hose | 1 | |
| 18 | Plate | 1 | |
| | | | Reverse the removal steps for installation. |

## SERVICE POINTS

### Exhaust system inspection

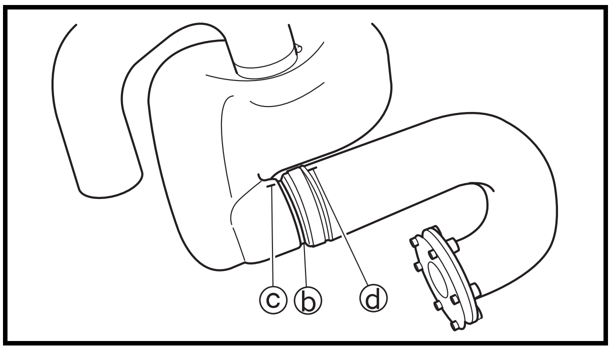
1. Inspect:
   - Water lock band
     Cracks/damage → Replace.
2. Inspect:
   - Rubber hoses
     Burns/cracks/damage → Replace.
3. Inspect:
   - Water lock
     Cracks/leaks → Replace.
4. Inspect:
   - Water tank
     Cracks/damage/leaks → Replace.




### Exhaust component parts sub-assembly

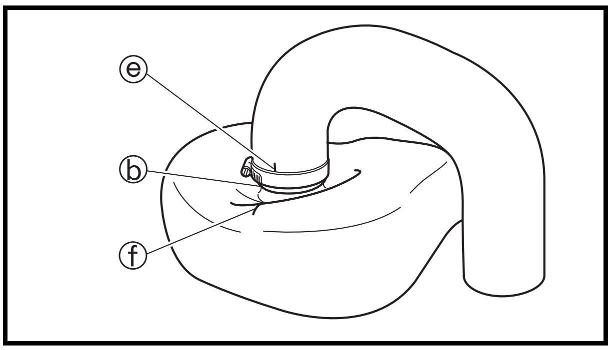
1. Install:
   - Rubber hose
   - Plate

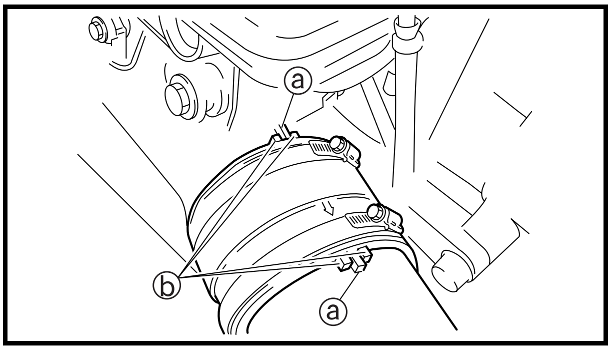
**NOTE:**
Be sure to fit the projections ⓐ on the rubber hose with the grooves in the plate.




2. Install:
   - Rubber hoses
   - Water tank

**NOTE:**
- Be sure to insert the rubber hose to the line ⓑ on the water tank.
- Align the parting line ⓒ of the water tank with the parting line ⓓ of the rubber hose.
- Align the parting line ⓔ of the rubber hose with the parting line ⓕ of the water tank.





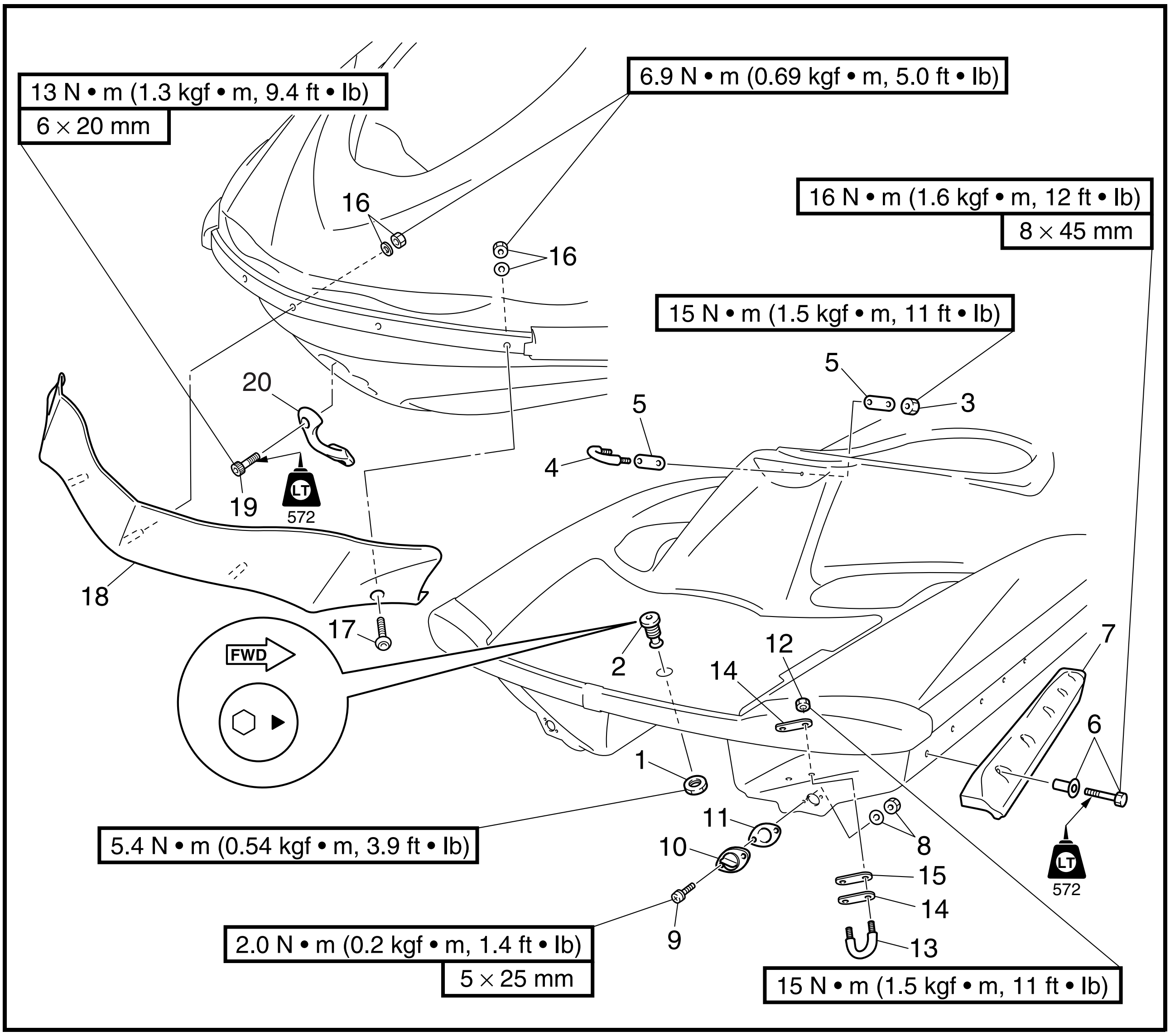

**Exhaust system installation**

1. Install:
   - Exhaust joint

**NOTE:**

Be sure to install the projections ⓐ on the exhaust pipe and exhaust joint into the slots ⓑ in the joint.

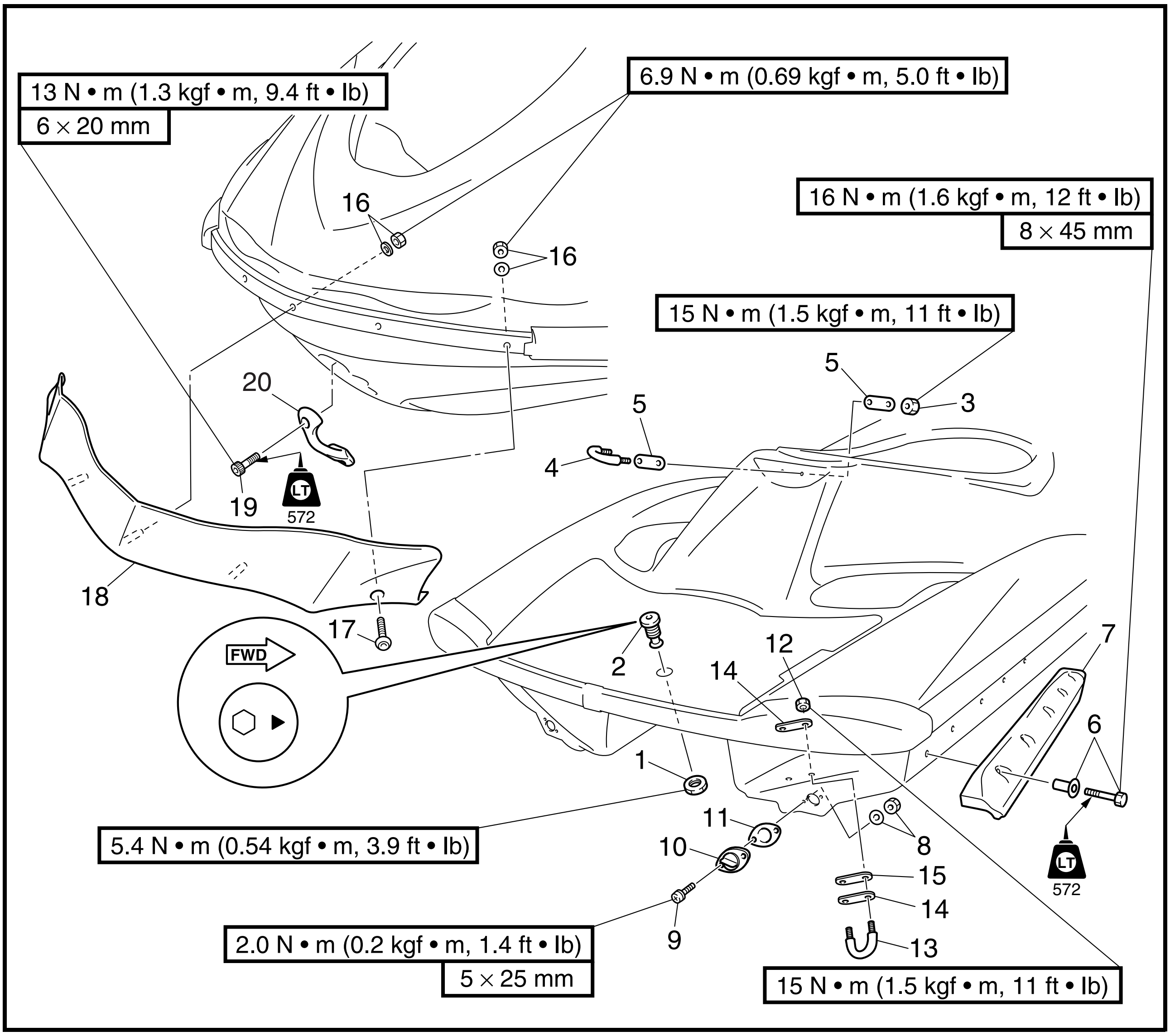
# DECK AND HULL
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

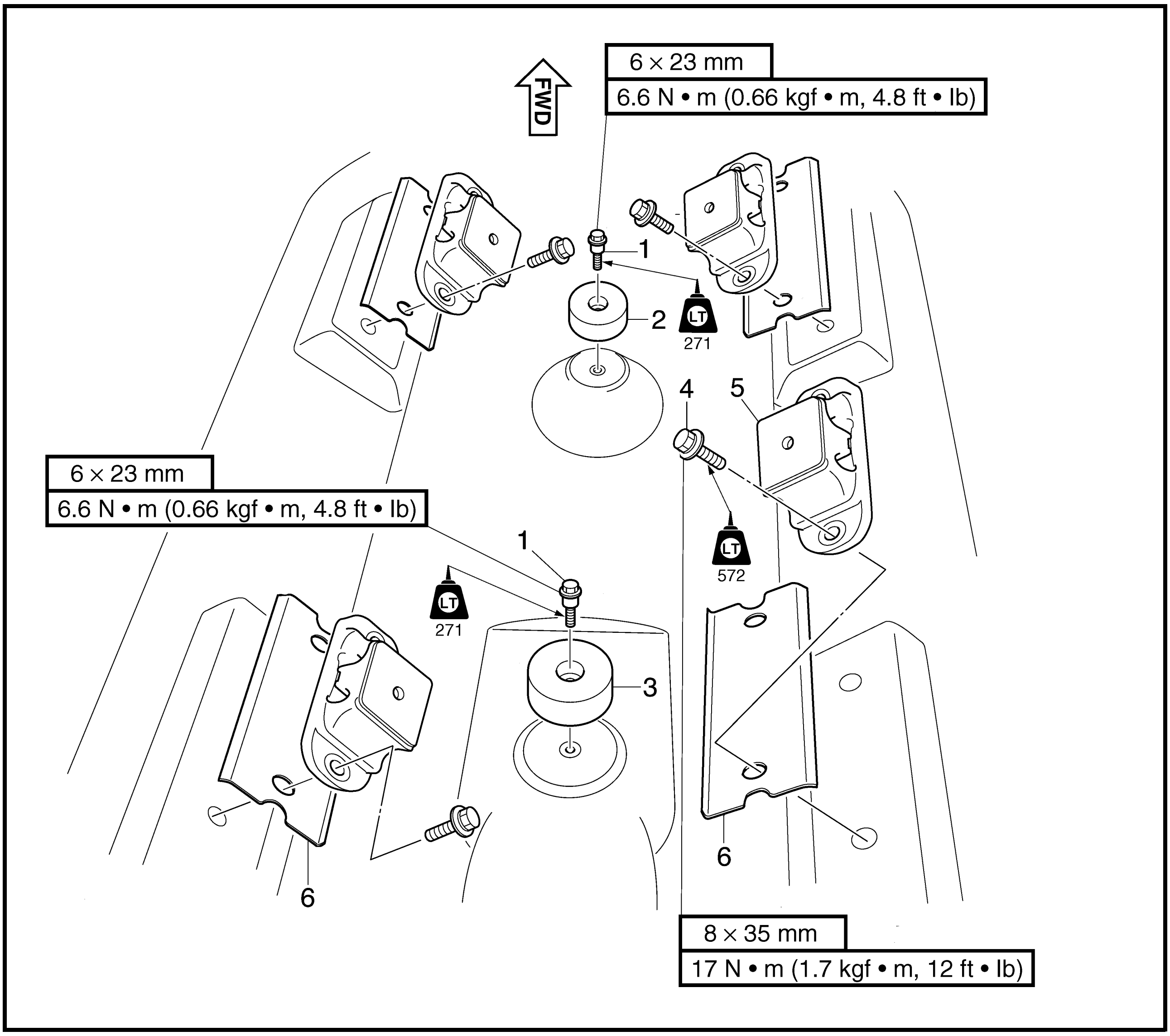
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **DECK AND HULL DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Nut | 1 | |
| 2 | Spout | 1 | |
| 3 | Nut | 2 | |
| 4 | Cleat | 1 | |
| 5 | Plate | 2 | |
| 6 | Bolt/collar | 10/10 | |
| 7 | Sponson | 2 | |
| 8 | Nut/washer | 4/4 | |
| 9 | Screw/washer | 4/4 | |
| 10 | Drain plug | 2 | |
| 11 | Seal | 2 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 12 | Nut | 4 | **NOTE:** To remove the cleat, remove the exhaust system first. |
| 13 | Cleat | 2 | |
| 14 | Plate | 4 | |
| 15 | Seal | 2 | |
| 16 | Nut/washer | 5/5 | |
| 17 | Bolt | 2 | |
| 18 | Protector | 1 | |
| 19 | Bolt | 2 | |
| 20 | Bow eye | 1 | |
| | | | Reverse the disassembly steps for assembly. |

# ENGINE MOUNT
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **ENGINE MOUNT REMOVAL** | | Follow the left "Step" for removal. |
| | Engine unit | | Refer to "ENGINE UNIT" in Chapter 5. |
| 1 | Bolt | 2 | |
| 2 | Damper 1 | 1 | |
| 3 | Damper 2 | 1 | |
| 4 | Bolt | 8 | |
| 5 | Engine mount | 4 | |
| 6 | Liner | 4 | |
| | | | Reverse the removal steps for installation. |

# CHAPTER 9
# TROUBLE ANALYSIS

# INTRODUCTION

## FEATURES

The newly developed Yamaha Diagnostic System provides quicker detection and analysis of engine malfunctions.
By connecting your computer to the ECM (Electronic Control Module) of a watercraft using the communication cable, this software can be used to display sensor data and data stored in the ECM on a computer's monitor.
If this software is run on Microsoft Windows® 95, Windows 98, Windows Me, Windows 2000, or Windows XP the information can be displayed in colorful graphics. Also, the software can be operated using either a mouse or a keyboard.
In addition, the data for the main functions (Diagnosis, Diagnosis record, Engine monitor, and Data logger) can be saved on a disk or printed out.

**Functions**

1. **Diagnosis:** Each sensor's status and each ECM diagnosis code or item are displayed. This enables you to find malfunctioning parts and controls quickly.
2. **Diagnosis record:** Sensors that had been activated and ECM diagnostic codes that have been recorded are displayed. This allows you to check the watercraft's record of malfunctions.
3. **Engine monitor:** Each sensor's status and the ECM data are displayed. This enables you to find malfunctioning parts quickly. In addition, the data displayed using the Engine Monitor function can be displayed in a graph.
4. **Stationary test:** Operation tests can be performed with the engine off.
5. **Active test:** Operation tests can be performed with the engine running.
6. **Data logger:** From the data stored in the ECM, at least two items of 78 seconds of recorded data are displayed on a graph. In addition, the operating time as compared to the engine speed and the total operating time are displayed. This allows you to check the operating status of the engine. For some models, you can also save the ECM record data in a file so that you can read and display the graph later.
7. **Some files:** Lets you select and run other applications while continuing to run the diagnostic program.

## CONTENTS

1. CD-ROM (software + instruction manual) (1)
2. Adapter (1)
3. Communication cable (1)




① ② ③

## HARDWARE REQUIREMENTS

Make sure that your computer meets the following requirements before using this software.

| | |
|---|---|
| Computer: | IBM PC/AT compatible computer |
| Operating system: | Microsoft Windows 95, Windows 98, Windows Me, Windows 2000, or Windows XP (English version) |
| CPU: | |
| Windows 95/98: | i486X, 100 MHz or higher (Pentium 100 MHz or higher recommended) |
| Windows Me/2000: | Pentium, 166 MHz or higher (Pentium 233 MHz or higher recommended) |
| Windows XP: | Pentium, 300 MHz or higher (Pentium 500 MHz or higher recommended) |
| Memory: | |
| Windows 95/98: | 16 MB or more (32 MB or more recommended) |
| Windows Me: | 32 MB or more (64 MB or more recommended) |
| Windows 2000: | 64 MB or more (128 MB or more recommended) |
| Windows XP: | 128 MB or more (256 MB or more recommended) |
| Hard disk free space: | 20 MB or more (40 MB or more recommended) |
| Drive: | CD-ROM drive |
| Display: | VGA (640 × 480 pixels), (SVGA [800 × 600 pixels] or more recommended) 256 or more colors |
| Mouse: | Compatible with the operating systems mentioned above |
| Communication port: | RS232C (Dsub-9 pin) port, USB port |
| Printer: | Compatible with the operating systems mentioned above |

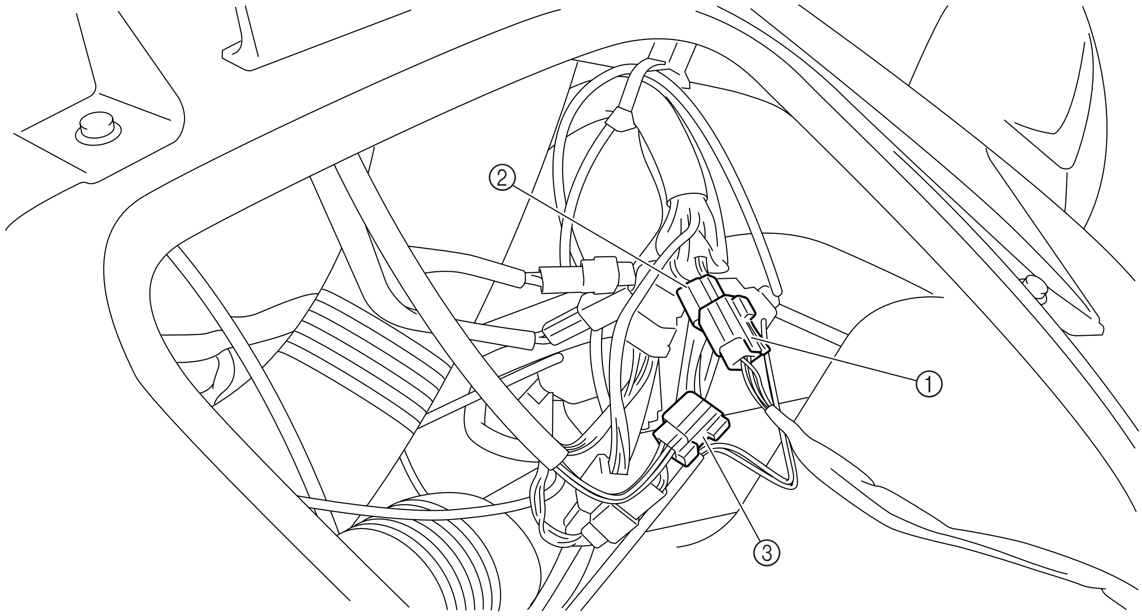
**NOTE:**

- The amount of memory and the amount of free space on the hard disk differs depending on the computer.
- Using this software while there is not enough free space on the hard disk could cause errors and result in insufficient memory.
- This software will not run properly on some computers.
- When starting up this program, do not start other software applications.
- Do not use the screen saver function or the energy saving feature when using this program.
- If the ECM is changed, restart the program.
- Windows XP is a multiuser operating system, therefore, be sure to end this program if the login user is changed.
- The USB adapter cannot be used with Windows 95.

For operating instructions of the Yamaha Diagnostic System, refer to “Yamaha Diagnostic System Instruction manual”.

# OPERATING
## CONNECTING THE COMMUNICATION CABLE TO THE WATERCRAFT

**Top view**




① 3-pin communication coupler
② Wiring harness coupler
③ Meter coupler

**NOTE:**
Be careful not to pinch the communication cable between the **hood** and the **deck** or to damage it.

# TROUBLE ANALYSIS

**NOTE:**

Before consulting the "TROUBLE ANALYSIS CHART," check the following items.

1. Check that the battery is charged and that its specified gravity is within specification.
2. Check that there are no incorrect wiring connections.
3. Check that all wiring connections are properly secured and that they are not rusty.
4. Check that the engine shut-off cord (lanyard) is connect to the engine shut-off switch.
5. Check that fuel is reaching the fuel rail.

## TROUBLE ANALYSIS CHART

| Trouble mode | | | | | | | | | | | | | | | Check elements | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ENGINE WILL NOT START | HARD STARTING | ROUGH IDLING | HIGH IDLING | ENGINE STALLS | POOR ACCELERATION | ENGINE WILL NOT STOP | POOR PERFORMANCE | LIMITED ENGINE SPEED | OVERHEATING | LOW OIL PRESSURE | LOOSE STEERING | BILGE INCREASE | IRREGULAR WARNING INDICATION | POOR BATTERY CHARGING | Relative part | Reference chapter |
| | | | | | | | | | | | | | | | FUEL SYSTEM | |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Fuel tank | 4 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Fuel tank breather hose | 4 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Fuel hose | 4 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Fuel filter | 4 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Fuel pump | 4 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Fuel rail | 4 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Fuel injectors | 4 |
| | | | | ○ | | | ○ | | | | | | | | Trolling speed | 3 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Air filter | 3 |

# TROUBLE ANALYSIS



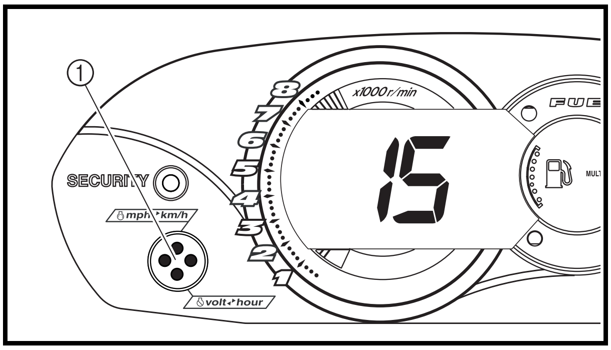
| Trouble mode | | | | | | | | | | | | | | | Check elements | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ENGINE WILL NOT START | HARD STARTING | ROUGH IDLING | HIGH IDLING | ENGINE STALLS | POOR ACCELERATION | ENGINE WILL NOT STOP | POOR PERFORMANCE | LIMITED ENGINE SPEED | OVERHEATING | LOW OIL PRESSURE | LOOSE STEERING | BILGE INCREASE | IRREGULAR WARNING INDICATION | POOR BATTERY CHARGING | Relative part | Reference chapter |
| | | | | | | | | | | | | | | | POWER UNIT | |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Compression | 5 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | ○ | ○ | | | | | Cylinder head gaskets | 5 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | ○ | | | | | | Cylinder block | 5 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | ○ | | | | | Crankcase | 5 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Piston rings | 5 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Pistons | 5 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Bearings | 5 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | | | Valve(s) and valve seat(s) | 5 |
| ○ | | ○ | | | ○ | | ○ | ○ | | | | | | | Valve clearance adjusting pad(s) | 3 |
| ○ | | ○ | | ○ | ○ | | ○ | | | | | | | | Camshaft(s) | 5 |
| ○ | | | | ○ | ○ | | ○ | | | | | | | | Timing chain | 5 |
| | | | | | | | | | | ○ | | | | | Oil pump | 5 |
| | | | | | | | | ○ | | ○ | | | | | Engine oil | 3 |
| | | | | | | | | | | ○ | | | | | Oil filter | 3 |
| | | | | | | | | | | ○ | | | ○ | | Oil pressure switch | 7 |
| | | | | | | | ○ | | | | | | | | Bearing housing | 5 |
| | | ○ | | | | | ○ | | | | | | | | Drive couplings | 5 |
| | | | | | | | ○ | | | | | | | | Rubber coupling | 5 |
| | | | | | | | | | ○ | | | ○ | | | Pilot water hose | 5 |
| | | | | | | | | | ○ | | | ○ | | | Water hose | 5 |
| | | | | | | | | | ○ | | | ○ | | | Water passage | 5 |

# TROUBLE ANALYSIS



| ENGINE WILL NOT START | HARD STARTING | ROUGH IDLING | HIGH IDLING | ENGINE STALLS | POOR ACCELERATION | ENGINE WILL NOT STOP | POOR PERFORMANCE | LIMITED ENGINE SPEED | OVERHEATING | LOW OIL PRESSURE | LOOSE STEERING | BILGE INCREASE | IRREGULAR WARNING INDICATION | POOR BATTERY CHARGING | Relative part | Reference chapter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | JET PUMP UNIT | |
| | | | | | | | ○ | | ○ | | | ○ | | | Duct | 6 |
| | | | | | | | ○ | | | | | | | | Impeller | 6 |
| | | | | | | | ○ | | ○ | | | | | | Intake grate | 6 |
| | | ○ | | | | | ○ | | | | | | | | Bearings | 6 |
| | | | | | | | | | ○ | | | | | | Water inlet hose | 6 |
| | | | | | | | | | | | | ○ | | | Bilge hose | 6 |
| | | | | | | | | | | | | ○ | | | Bilge strainer | 3 |
| | | | | | | | | | | | | ○ | | | Bilge hose joint | 6 |
| | | | | | | | | | | | | | | | ELECTRICAL | |
| | | | | | | | | | | | | | | | Ignition system, fuel control system | |
| ○ | ○ | ○ | | ○ | ○ | | ○ | | | | | | ○ | | • Pickup coils | 7 |
| ○ | | | ○ | ○ | | ○ | ○ | ○ | | | | | | | • ECM | 7 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | | | | | | | | • Ignition coils | 7 |
| ○ | | | | ○ | | | | | | | | | ○ | | • Slant detection switch | 7 |
| ○ | | | | | | ○ | | | | | | | | | • Engine stop switch | 7 |
| ○ | | | | | | ○ | | | | | | | | | • Engine shut-off switch | 7 |
| ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | | | • Spark plugs | 3 |
| ○ | | ○ | | ○ | | ○ | ○ | | | | | | | | • Main and fuel pump relay | 7 |
| ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | | | ○ | | • Electronic control throttle valve relay | 7 |
| | | | | | | | ○ | | ○ | | | | ○ | | • Thermoswitch | 7 |
| | ○ | ○ | ○ | | ○ | | ○ | ○ | | | | | ○ | | • Sensor assembly | 7 |
| | ○ | ○ | ○ | | | | | ○ | | | | | ○ | | • Engine temperature sensor | 7 |
| ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ | | | | | ○ | | • Throttle body assembly (throttle position sensor) | 7 |
| ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ | | | | | ○ | | • Accelerator position sensor | 7 |
| ○ | ○ | ○ | | ○ | ○ | | ○ | ○ | | | | | ○ | | • Cam position sensor | 7 |

| Trouble mode | | | | | | | | | | | | | | | Check elements | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ENGINE WILL NOT START | HARD STARTING | ROUGH IDLING | HIGH IDLING | ENGINE STALLS | POOR ACCELERATION | ENGINE WILL NOT STOP | POOR PERFORMANCE | LIMITED ENGINE SPEED | OVERHEATING | LOW OIL PRESSURE | LOOSE STEERING | BILGE INCREASE | IRREGULAR WARNING INDICATION | POOR BATTERY CHARGING | Relative part | Reference chapter |
| | | | | | | | | | | | | | | | Starting system | |
| ○ | ○ | | | | | ○ | | | | | | | | | • Start switch | 7 |
| ○ | | | | | | ○ | | | | | | | | | • Starter relay | 7 |
| ○ | | | | | | | | | | | | | | | • Starter motor | 7 |
| | | | | | | | | | | | | | | | Charging system | |
| | | | | | | | | | | | | | | ○ | • Lighting coil | 7 |
| | | | | | | | | | | | | | | ○ | • Rectifier/regulator | 7 |
| ○ | | ○ | ○ | ○ | | | | | | | | | | ○ | • Fuses | 7 |
| ○ | | ○ | | ○ | | | | | | | | | | ○ | • Battery leads | — |
| ○ | ○ | ○ | ○ | ○ | | | | | | | | | | ○ | • Battery | 3 |
| | | | | | | | | | | | | | | | Remote control system (Deluxe model only) | |
| ○ | | | | | | | | | | | | | | | • Remote control unit | 7 |
| | | | | | | | | | | | | | | | HULL AND HOOD | |
| | | | | | | | | | | | ○ | | | | Steering column | 8 |
| | | | | | | | ○ | | | | | ○ | | | Water lock | 8 |
| | | | | ○ | | | ○ | | | | | ○ | | | Exhaust hose | 8 |
| | | | | | | | ○ | | | | | ○ | | | Muffler | 8 |
| | | | | | | | | | | | | ○ | | | Drain plugs | 8 |




## SELF-DIAGNOSIS

With the engine running, press the select button ① for 8 seconds and check if an error code is indicated on the multifunction meter.

| Code | Symptom |
|---|---|
| 01 | Normal |
| 13 | Pickup coil malfunction |
| 15 | Engine temperature sensor malfunction |
| 19 | Incorrect battery voltage |
| 23 | Intake air temperature sensor malfunction |
| 24 | Cam position sensor malfunction |
| 29 | Intake air pressure sensor malfunction |
| 47 | Slant detection switch malfunction |
| 48 | Incorrect data transmission |
| 55 | Steering switch malfunction |
| 112–123 | Electronic control throttle system malfunction |
| 124–128 | Throttle position sensor malfunction |
| 129 | Electronic control throttle system malfunction |
| 131–135 | Accelerator position sensor malfunction |
| 136–139 | Electronic control throttle system malfunction |
| 141–145 | Electronic control throttle system malfunction |

If the Yamaha Diagnostic System is not used to check the symptoms listed in the table, the error codes can be checked easily with the self-diagnosis in the multifunction meter. However, if there are numerous error codes displayed, be sure to check them with the Yamaha Diagnostic System.

# WIRING DIAGRAM
## VX110 Sport

① Battery
② Starter motor
③ Fuse (30 A)
④ Fuse (20 A)
⑤ Fuse (3 A)
⑥ Fuse (10 A)
⑦ Fuse (10 A)
⑧ Starter relay
⑨ Main and fuel pump relay
⑩ Electronic control throttle valve relay
⑪ Slant detection switch
⑫ Ignition coil
⑬ Spark plug
⑭ Cam position sensor
⑮ Sensor assembly
(intake air pressure and intake air temperature)
⑯ Engine temperature sensor
⑰ Thermoswitch (engine)
⑱ Thermoswitch (exhaust)
⑲ Oil pressure switch
⑳ Fuel injector
㉑ ECM
㉒ Rectifier/regulator
㉓ Throttle body assembly
㉔ Accelerator position sensor
㉕ Pickup coil
㉖ Lighting coil
㉗ Buzzer
㉘ Electric fuel pump
㉙ Steering sensor
㉚ Fuel sender
㉛ Speed sensor
㉜ Multifunction meter
㉝ Start switch
㉞ Engine stop switch
㉟ Engine shut-off switch

[A] To tachometer

## Color code

B : Black
Br : Brown
G : Green
Gy : Gray
L : Blue
O : Orange
P : Pink
R : Red
W : White
Y : Yellow
B/G : Black/green
B/O : Black/orange
B/R : Black/red
B/W : Black/white
B/Y : Black/yellow
G/B : Green/black
G/O : Green/orange
G/R : Green/red
G/Y : Green/yellow
L/R : Blue/red
P/G : Pink/green
P/W : Pink/white
Pu/B : Purple/black
Pu/G : Purple/green
Pu/R : Purple/red
Pu/Y : Purple/yellow
R/W : Red/white
R/Y : Red/yellow
W/B : White/black
W/L : White/blue
W/R : White/red
Y/G : Yellow/green
Y/W : Yellow/white

# WIRING DIAGRAM
## VX110 Deluxe

① Battery
② Starter motor
③ Fuse (30 A)
④ Fuse (20 A)
⑤ Fuse (3 A)
⑥ Fuse (10 A)
⑦ Fuse (10 A)
⑧ Starter relay
⑨ Main and fuel pump relay
⑩ Electronic control throttle valve relay
⑪ Slant detection switch
⑫ Ignition coil
⑬ Spark plug
⑭ Cam position sensor
⑮ Sensor assembly
(intake air pressure and intake air temperature)
⑯ Engine temperature sensor
⑰ Thermoswitch (engine)
⑱ Thermoswitch (exhaust)
⑲ Oil pressure switch
⑳ Fuel injector
㉑ Remote control unit
㉒ Antenna
㉓ ECM
㉔ Rectifier/regulator
㉕ Throttle body assembly
㉖ Accelerator position sensor
㉗ Pickup coil
㉘ Lighting coil
㉙ Buzzer
㉚ Electric fuel pump
㉛ Steering sensor
㉜ Fuel sender
㉝ Speed sensor
㉞ Multifunction meter
㉟ Start switch
㊱ Engine stop switch
㊲ Engine shut-off switch

[A] To entry box
[B] To tachometer

### Color code

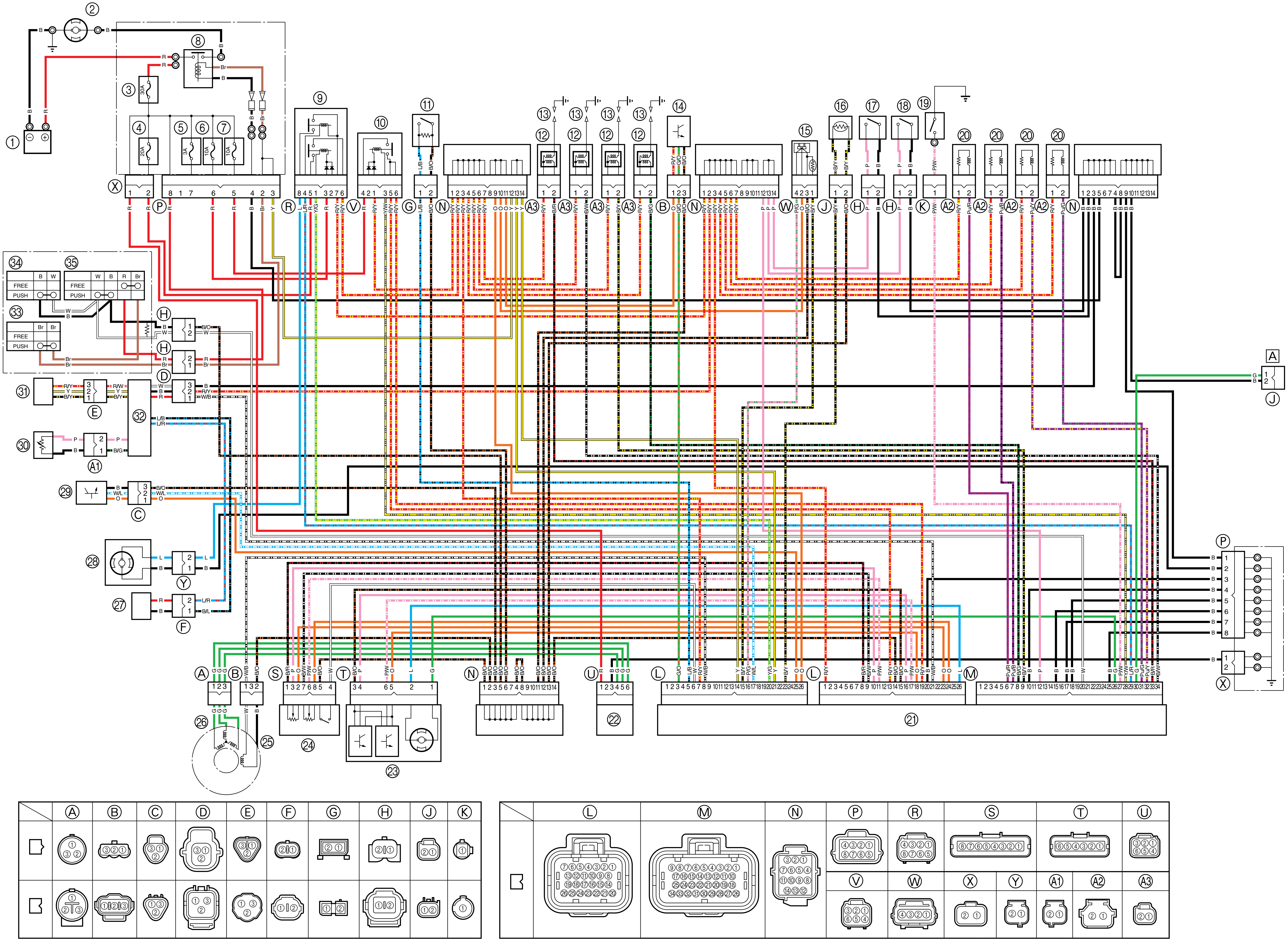
B : Black
Br : Brown
G : Green
Gy : Gray
L : Blue
O : Orange
P : Pink
R : Red
W : White
Y : Yellow
B/G : Black/green
B/O : Black/orange
B/R : Black/red
B/W : Black/white
B/Y : Black/yellow
G/B : Green/black
G/O : Green/orange
G/R : Green/red
G/Y : Green/yellow
L/B : Blue/black
L/R : Blue/red
L/Y : Blue/yellow
P/G : Pink/green
P/W : Pink/white
Pu/B : Purple/black
Pu/G : Purple/green
Pu/R : Purple/red
Pu/Y : Purple/yellow
R/W : Red/white
R/Y : Red/yellow
W/B : White/black
W/L : White/blue
W/R : White/red
Y/G : Yellow/green
Y/W : Yellow/white

YAMAHA

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(E)

## VX110 Sport



# VX110 Deluxe

